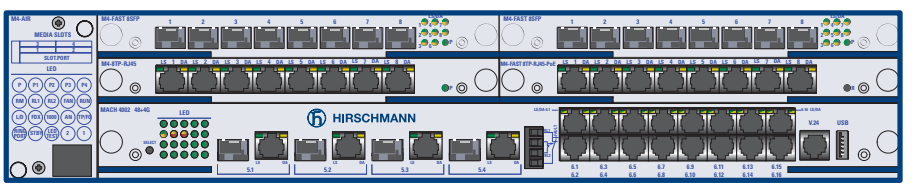
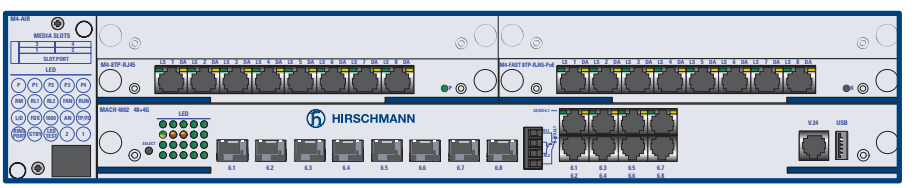
HIRSCHMANN
A BELDEN BRAND

User Manual

Installation
Modular Industrial ETHERNET Backbone Switch
MACH 4000 Family



MACH 4002-48+4G



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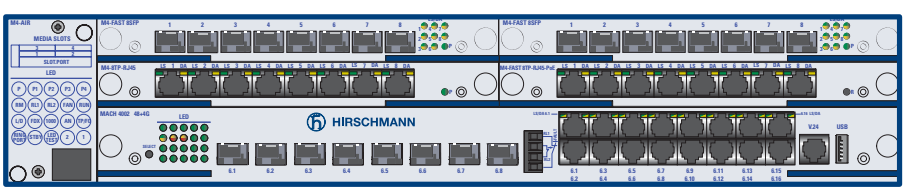

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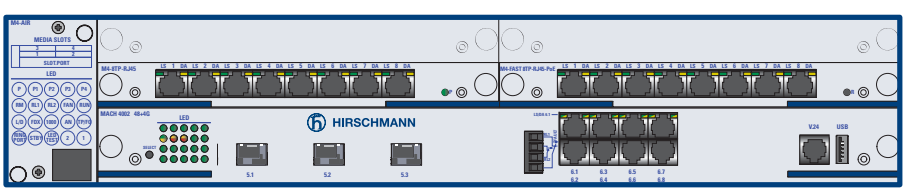

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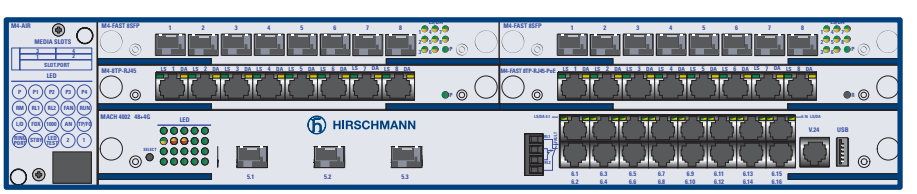

MACH 4002-48G+3X

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Safety instructions

This documentation contains instructions which must be observed to ensure your own personal safety and to avoid damage to devices and machinery.

Certified usage

Please observe the following: The device may only be employed for the purposes described in the catalog and technical description, and only in conjunction with external devices and components recommended or approved by the manufacturer. The product can only be operated correctly and safely if it is transported, stored, installed and assembled properly and correctly. Furthermore, it must be operated and serviced carefully.

Supply voltage

The devices with DC voltage supply are designed for operation with safety extra-low voltage. Accordingly, only SELV circuits with voltage restrictions in line with IEC/EN 60950-1 may be connected to the DC supply voltage connections.

For safety reasons, the fuse installed in the plug-in power supply units may not be changed.

- ☐ The complete defective plug-in power supply unit must be changed.
- ☐ Only switch on the device when the housing is closed. Close all empty slots with a covering panel.

Warning!
Only connect a supply voltage that corresponds to the type plate of your device.

Warning: Install an input fuse in the ungrounded voltage cables for every voltage supply connection.
For the AC input of the AC/DC plug-in power units, use a nominal rating of not more than 10 A - characteristic B.
For the DC input of the DC plug-in power units at P1 and P2, use a nominal rating of not more than 20 A - slow-blow characteristic.
Do not use a redundant voltage supply at P1 and P2 simultaneously if one of the “+” connections of P1 or P2 is grounded. For the current conductors at the voltage input of the AC/DC power units, use a cable cross-section of at least 1.0 mm².
For the current conductors at the voltage input of the DC power units, use a cable cross-section of at least 2.5 mm².

☐ The DC modules (M4-...-...VDC 300W) are designed for operation with safety extra-low voltage. Accordingly, only SELV circuits with voltage restrictions in line with IEC/EN 60950-1 may be connected to the supply voltage connections.
☐ Only connect the mains voltage when the power supply units are securely screwed to the housing.
☐ If you are using the M4-POWER power unit chassis: Check the configuration of the connection plug and the power supply cable to the switch chassis before you connect an external voltage to the M4-POWER inputs.
☐ Only use connection cables that are permitted for a temperature range from 0 °C to 60 °C.

Warning: The power supply cables between the M4-POWER power unit chassis and the MACH 4000 are hot-swappable. Note the sequence for connecting the cables: First connect the power supply cable(s) between M4-POWER and MACH 4000. Then connect the power supply (AC or DC, depending on the plug-in power unit) for the M4-POWER.

Warnung: The power supply cables between the M4-POWER power unit chassis and the MACH 4000 are energized with intra-system safety extra-low voltages. Exclusively use the M4-POWER CABLE power supply cable and the M4-POWER power unit chassis for redundant power supply. Do not connect any other external power supply unit.

Relevant for North America:

Warning: Install an input fuse in the ungrounded voltage cables for every voltage supply connection. For the AC input of the AC/DC plug-in power units, use a nominal rating of not more than 10 A - slow-blow characteristic. For the DC input of the DC plug-in power units at P1 and P2, use a nominal rating of not more than 20 A - slow-blow characteristic.
Do not use a redundant voltage supply at P1 and P2 simultaneously if one of the “+” connections of P1 or P2 is grounded.
For the current conductors at the voltage input of the AC/DC power units, use a cable cross-section of at least AWG16.
For the current conductors at the voltage input of the DC power units, use a cable cross-section of at least AWG12.

☐ Use copper conductors 75 °C only.

Reliable earthing

Reliable earthing of rack-mounted equipment should be maintained. Particular attention should be given to supply connections other than direct connections to the branch circuit (e.g. use of power strips).

Signal contacts („FAULT“)

Only SELV circuits with voltage restrictions in line with IEC/EN 60950-1 may be connected to the signal contacts.

Shielding ground

The shielding ground of the connectable twisted pairs lines is connected to the front panel as a conductor.

☐ Beware of possible short circuits when connecting a cable section with conductive shielding braiding.

Housing

Only technicians authorized by Hirschmann are permitted to open the housing.

The device is grounded via the voltage supply socket.

☐ Make sure that the electrical installation meets local or nationally applicable safety regulations.

☐ Reduced air flow: Installation of the equipment in a rack should be such that the amount of air flow required for safe operation of the equipment is not compromised.

☐ The ventilation slits must not be covered so as to ensure free air circulation.

☐ The clearance to the ventilation slits of the housing must be at least 10 cm (3.94 in).

☐ Do not operate the device without a plug-in fan (see page 20 „Fan“).

Warning!

Never insert sharp objects (small screwdrivers, wires, etc.) into the inside of the product. There is the risk of an electric shock.

☐Close all empty slots with a covering panel.

☐ Modules, fans and power supply units of a switched-on device may only be installed or deinstalled by an electrician.

☐ Fans are subject to natural wear. The failure of one or more fans in the plug-in fan can have a negative effect on the operation and life span of the device, or can lead to a total failure.

Therefore, you should use the device's monitoring function for the fan and the temperature.

Depending on your installation conditions, you can continue operating your device when one fan fails.

Note the temperature display of your device:

- In the Command Line Interface, with the command: show temperature.

- In the Web-based interface, in the dialog Basic Settings: System, Temperature
The temperature display must never exceed the maximum value (see the following list):

Device	Maximum Value
MACH4002-48+4G	+75 °C
MACH4002-24G	+80 °C
MACH4002-24G+3XG	+80 °C
MACH4002-48G	+80 °C
MACH4002-48G+3XG	+80 °C

☐ The basic board must not be removed.
Removing the basic board invalidates the guarantee.
☐ The chassis should be installed in the horizontal position.
☐ After the device is switched off, the fan blades continue rotating for a number of seconds. Do not reach into a rotating fan!
☐ The internal workings of the basic device are not for users! Do not reach inside a switched-on device because of the danger caused by high energy densities.
☐ When fully equipped with media modules, the device weighs up to 10 kg. Please comply with the legally stipulated maximum weight when dealing with heavy objects.
☐ If you are operating the device in a 19" switch cabinet: install sliding/ mounting rails for holding the device (see page 31 „Setting up/mounting the basic switch device in the 19" rack“).

Warning
If the device is installed in a 19" switch cabinet without sliding/ mounting rails, increased vibration can cause damage to the device and/or its modules.

Warning
When installing the device, make sure the ventilation slots remain unobstructed, as otherwise the device can overheat and be damaged.

Environment

The device may only be operated at the specified maximum ambient temperature and relative air humidity (non-condensing).
☐ Install the device in a location where the climatic threshold values specified in the technical data are adhered to.
☐ Only to be used in an environment with the contamination level specified in the technical data.

- ☐ Elevated operating ambient: If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient. Therefore, consideration should be given to installing the equipment in an environment compatible with the maximum ambient temperature t_{max} specified by the manufacturer.
- ☐ Mechanical loading: Mounting of the equipment in the rack should be such that a hazardous condition is not achieved due to uneven mechanical loading.

Qualification requirements for personnel

Qualified personnel as understood in this manual and the warning signs, are persons who are familiar with the setup, assembly, startup, and operation of this product and are appropriately qualified for their job. This includes, for example, those persons who have been:

- ▶ trained or directed or authorized to switch on and off, to ground and to label power circuits and devices or systems in accordance with current safety engineering standards;
- ▶ trained or directed in the care and use of appropriate safety equipment in accordance with the current standards of safety engineering;
- ▶ trained in providing first aid.

General safety instructions

Electricity is used to operate this equipment. Comply in every detail with the safety requirements specified in the operating instructions regarding the voltages to apply (refer to page 5).

Non-observance of these safety instructions can therefore cause material damage and/or serious injuries.

- ☐ Only appropriately qualified personnel should work on this device or in its vicinity. These personnel must be thoroughly familiar with all the warnings and maintenance procedures in accordance with this operating manual.
- ☐ The proper and safe operation of this device depends on proper handling during transport, proper storage and assembly, and conscientious operation and maintenance procedures.
- ☐ Never start operation with damaged components.
- ☐ Only use the devices in accordance with this manual. In particular, observe all warnings and safety-related information.
- ☐ Any work that may be required on the electrical installation may only be carried out by personnel trained for this purpose.

Note:

LED or LASER components in compliance with IEC 60825-1 (2001):
CLASS 1 LASER PRODUCT
CLASS 1 LED PRODUCT

National and international safety regulations

☐ Make sure that the electrical installation meets local or nationally applicable safety regulations.

ESD Guidelines

The media modules are equipped with electrostatically sensitive components. These can be destroyed, or their life cycles reduced, by the effects of an electrical field or by a charge equalization if the card is touched. For this reason, the cards are packaged in a conductive ESD protective bag on delivery. The packaging can be reused.

Make sure you adhere to the following protection measures for electrostatically endangered assemblies:

☐ Create electrical equipotential bonding between yourself and your environment, e.g. using a wristband, which you clamp to the basic device (knurled screw of an interface card). When the power supply cable is connected, the basic device is grounded via the power supply connection.
☐ Only now do you take the card out of the conductive bag.
☐ Outside the basic device, only store the cards in a conductive ESD protective bag.

ESD protective field equipment is available for the safe handling of electrostatically endangered assemblies.
You can find more information about electrostaticically endangered assemblies in DIN/IEC 47 (Sec) 1330; February 1994 Edition and DIN EN 100 015.

Note on the CE marking

The devices comply with the regulations contained in the following European directives:

2006/95/EG, 2004/108/EG
Directive of the European Parliament and the council for standardizing the regulations of member states with regard to electromagnetic compatibility.
In accordance with the above-named EU directives, the EU conformity declaration will be at the disposal of the relevant authorities at the following address:

Hirschmann Automation and Control GmbH
Stuttgarter Str. 45-51
72654 Neckartenzlingen
Tel.: +49 1805 141538

The product can be used in the industrial sector.

- Interference immunity: EN 61000-6-2:2005
- Emitted interference: EN 55022:2006 Class A

Warning
This is a class A device. This device can cause interference in living areas, and in this case the operator may be required to take appropriate measures.

The assembly guidelines provided in these instructions must be strictly adhered to in order to observe the EMC threshold values.

FCC note:

Appropriate testing has established that this device fulfills the requirements of a class A digital device in line with part 15 of the FCC regulations.
These requirements are designed to provide sufficient protection against interference when the device is being used in a business environment.
The device creates and uses high frequencies and can radiate same, and if it is not installed and used in accordance with this operating manual, it can cause radio transmission interference. The use of this device in a living area can also cause interference, and in this case the user is obliged to cover the costs of removing the interference.

Recycling note

After usage, this product must be disposed of properly as electronic waste in accordance with the current disposal regulations of your county / state / country.

About this manual

The following manuals are available as PDF files on the CD-ROM supplied:

- “Installation” user manual
- “Basic Configuration” user manual
- “Redundancy Configuration” user manual
- “Router Configuration” user manual
- “Web-based Interface” user manual and
- “Command Line Interface” user manual

The Network Management Software HiVision/Industrial HiVision provides you with additional options for smooth configuration and monitoring:

- Configuration of multiple devices simultaneously.
- Graphical interface with network layouts.
- Auto-topology discovery.
- Event log.
- Event handling.
- Client / Server structure.
- Browser interface
- ActiveX control for SCADA integration
- SNMP/OPC gateway

With the Industrial HiVision Network Management software, you increase your network security in industrial application areas:

- ETHERNET Early Warning System
- Easy monitoring of industrial networks
- Fast display
- Interface with diagnostic and configuration programs
- Low deployment cost

Legend

The commendations used in this manual have the following meanings:

▶	Listing
☐	Work step
■	Subheading

1 Device description

The modular, industry-compatible MACH 4000 Gigabit ETHERNET system is used as an industrial backbone system, and also in applications with high data volumes, such as Voice/Video over IP.

The MACH 4000 is a modular, industry-compatible Gigabit ETHERNET system in a 19" chassis that is also suitable for use as an industrial backbone system.

The MACH 4000 devices are designed for the special requirements of industrial automation. They meet the relevant industry standards, provide very high operational reliability, even under extreme conditions, and also long-term reliability and flexibility. The power is supplied by an AC or DC power unit at the back of the device, or it is supplied redundantly via a power unit chassis with up to three hot-swappable plug-in power units. The switches and the power unit chassis are suitable for mounting in the 19" rack.

The HIPER-Ring redundancy concept enables you to quickly carry out a reconfiguration, and also a simple configuration with only one additional connection.

The diagnosis LEDs for displaying the operating parameters provide a quick overview.

It can be easily managed via a Web browser, via Telnet, with a management software product (such as HiVision) or locally on the switch (V.24 interface).

The device allows you to set up switched industrial ETHERNET networks that conform to the IEEE 802.3 and 802.3u standards using copper wires or optical fibers in a line or ring structure. You can connect terminal devices and other infrastructure components via twisted pair cables, multi-mode F/O and single-mode F/O. The twisted pair ports support autocrossing, autonegotiation and autopolarity.

The M4-FAST 8TP-RJ45-PoE media module supports Power over ETHERNET in compliance with IEEE 802.3af.

Depending on the software you choose, the devices provide you with a large range of functions:

- Redundancy functions
  (Rapid Spanning Tree, Redundant Ring Structure, HIPER-Ring, Redundant Coupling, Link Aggregation, Redundant Power Supply)
- Protection from unauthorized access
- Synchronized system time in the network
- Network load control
- Operation diagnosis
- Diagnostics (hardware self-testing)
- Reset
- Priority

- VLAN
- Topology Discovery
- Web-based Interface
- Command Line Interface CLI
- SNMP
- 802.1x port authentication
- Real Time Clock
- Routing
- Access Control List ACL

The addition, to the MACH range of backbone switches, of the RS20/RS22/RS30/RS32/RS40 switches of the Open Rail range and the MACH range, the BAT wireless transmission system, the EAGLE security system, and products for the LION control room, provides continuous communication across all levels of the company.

1.1 MACH 4000 Basic Device

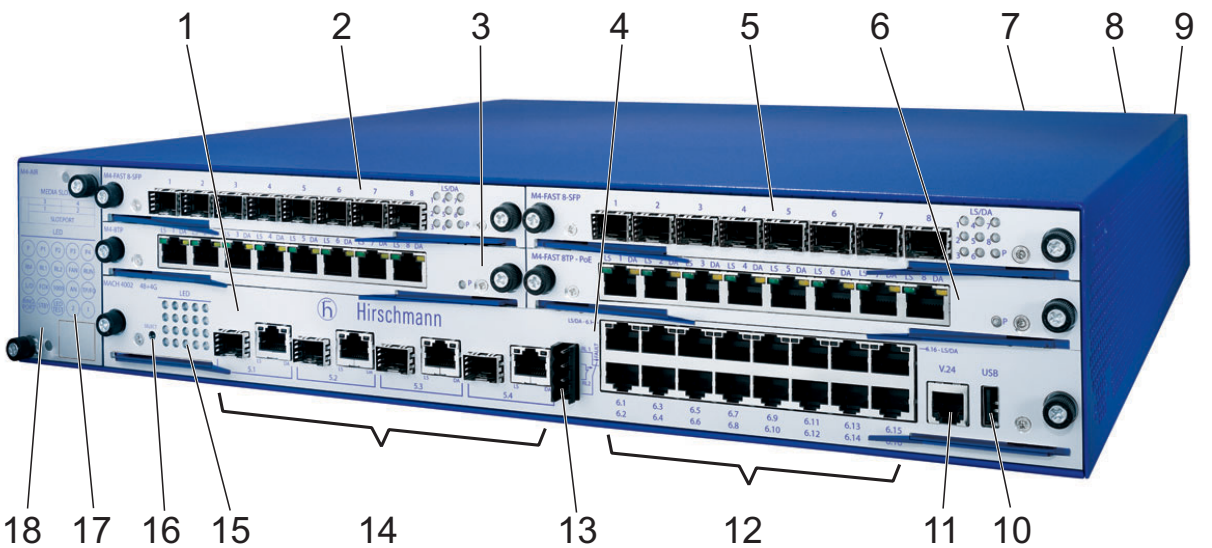


Figure 1: Structure of the basic device (example: MACH 4002-48+4G)
1 - Basic board (integrated) ports 5.1 to 5.4
2 - Media module 3 (slide-in module)
3 - Media module 1 (slide-in module)
4 - Basic board (integriert) ports 6.1 to 6.16
5 - Media module 4 (slide-in module)
6 - Media module 2 (slide-in module)
7 - Back side of the of device: power supply unit
8 - External connector to M4-POWER
9 - External connector to M4-POWER
10 - USB socket
11 - V.24 access for external management

12 - 16 TP ports (ports 6.1 to 6.16)
13 - Two switchable signal contacts
14 - 4 combo ports (ports 5.1 to 5.4)
15 - Displays
16 - SELECT key
17 - Legend of the displays
18 - Fan plug-in unit

Depending on the MACH 4000 device variant, the device provides you with the following ports and slots for equipping it with media modules:

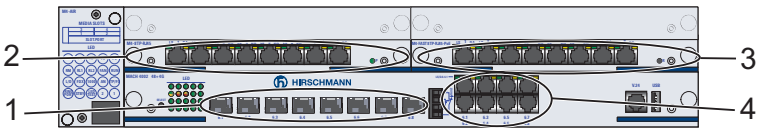


Figure 2: Ports and media module slots on the MACH 4002-24G
1 - Basic board (integrated), port 6.1 to 6.8, SFP 100/1000 Mbit/s (alternatively to the RJ45 ports 6.1 to 6.8)
2 - Media module 1 (slide-in module), port 1.1 to 1.8, 10/100/1000 Mbit/s
3 - Media module 2 (slide-in module), port 2.1 to 2.8, 10/100/1000 Mbit/s
4 - Basic board (integrated), port 6.1 to 6.8, RJ45 10/100/1000 Mbit/s

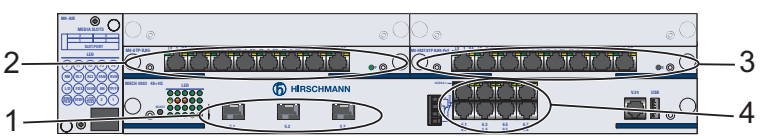


Figure 3: Ports and media module slots on the MACH 4002-24G+3X
1 - Basic board (integrated), port 5.1 to 5.3, XFP 10 Gbit/s
2 - Media module 1 (slide-in module), port 1.1 to 1.8, 10/100/1000 Mbit/s
3 - Media module 2 (slide-in module), port 2.1 to 2.8, 10/100/1000 Mbit/s
4 - Basic board (integrated)), port 6.1 to 6.8, RJ45 10/100/1000 Mbit/s

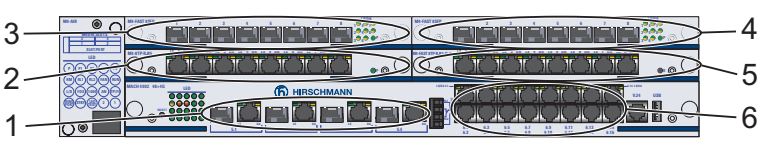


Figure 4: Ports and media module slots on the MACH 4002-48G+4G
1 - Basic board (integrated), port 5.1 to 5.4, RJ45 10/100/1000 Mbit/s, alternatively SFP 1000 Mbit/s
2 - Media module 1 (slide-in module), port 1.1 to 1.8, 10/100 Mbit/s
3 - Media module 3 (slide-in module), Port 3.1 to 3.8, 10/100 Mbit/s
4 - Media module 4 (slide-in module), Port 4.1 to 4.8, 10/100 Mbit/s
5 - Media module 2 (slide-in module), Port 2.1 to 2.8, 10/100 Mbit/s
6 - Basic board (integrated), Port 6.1 to 6.16, RJ45 10/100 Mbit/s

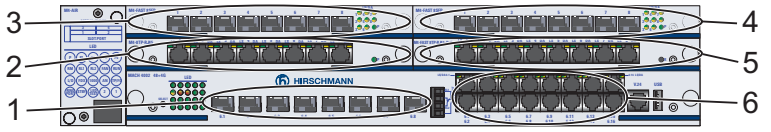


Figure 5: Ports and media module slots on the MACH 4002-48G
1 - Basic board (integrated), port 6.1 to 6.8, SFP 100/1000 Mbit/s (alternatively to the RJ45 ports 6.1 to 6.8)
2 - Media module 1 (slide-in module), port 1.1 to 1.8, 10/100/1000 Mbit/s
3 - Media module 3 (slide-in module), port 3.1 to 3.8, 10/100/1000 Mbit/s
4 - Media module 4 (slide-in module), port 4.1 to 4.8, 10/100/1000 Mbit/s
5 - Media module 2 (slide-in module), port 2.1 to 2.8, 10/100/1000 Mbit/s
6 - Basic board (integrated), port 6.1 to 6.16, RJ45 10/100/1000 Mbit/s

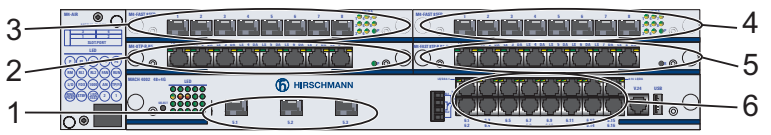


Figure 6: Ports and media module slots on the MACH 4002-48G+3X
1 - Basic board (integrated), port 5.1 to 5.3, XFP 10 Gbit/s
2 - Media module 1 (slide-in module), port 1.1 to 1.8, 10/100/1000 Mbit/s
3 - Media module 3 (slide-in module), port 3.1 to 3.8, 10/100/1000 Mbit/s
4 - Media module 4 (slide-in module), port 4.1 to 4.8, 10/100/1000 Mbit/s
5 - Media module 2 (slide-in module), port 2.1 to 2.8, 10/100/1000 Mbit/s
6 - Basic board (integrated), port 6.1 to 6.16, RJ45 10/100/1000 Mbit/s

Basic device	**Maximum port number of the device, in brackets number of intalled ports on the basic board**				**Max. number of media modules**		**Max. PoE power**
	TP ports, 10/100 Mbit/s	TP ports, 10/100/ 1000 Mbit/s	TP/SFP combo ports, 10/100/ 1000 Mbit/s	XFP slots, 10 Gbit/s	10/100 Mbit/s	10/100/ 1000 Mbit/s	
4002-48+4G	48 (16)	4 (-)	4 (4[a])	- (-)	4[b]	-	137 W
4002-24G	- (-)	24 (-)	8 (8[c])	- (-)	-	2	163 W
4002-48G	- (-)	48 (8)	8 (8[c])	- (-)	-	4	110 W
4002-24G+3X	- (-)	24 (8)	- (-)	3 (3)	-	2	157 W
4002-48G+3X	- (-)	48 (16)	- (-)	3 (3)	-	4	106 W

Table 1: Maximum number of ports and media modules and maximum PoE power

a. SFP 1000 Mbit/s
b. M4-8TP-RJ45, M4-8TP-RJ45-PoE or M4-FAST 8-SFP
c. SFP 100/1000 Mbit/s

The devices comply with the specifications of the standards:

- ISO/IEC 8802-3u 100BASE-TX/-1000BASE-TX
- ISO/IEC 8802-3 100BASE-FX
- ISO/IEC 8802-3 1000BASE-SX/LX

- ISO/IEC 8802-3 10GBASE-SR/LR

The MACH 4000 basic devices are 2 height modules high (approx. 88mm) and, depending on the device variant and the media modules that are connected, they provide you with

- up to 48 Fast ETHERNET ports
- up to 48 Gigabit ETHERNET ports
- up to three 10-Gigabit ETHERNET ports (see table 16 „Maximum number of ports and media modules and maximum PoE power“)

You can order the basic devices with different ranges of functions (see on page 52 „Order numbers/product description“). The software supplied defines the range of functions:

- Software Layer 2 Professional (L2P)
- Software Layer 3 Enhanced (L3E), static routing
- Software Layer 3 Professional (L3P), Multicast routing

Depending on the device variant, a basic device has 2 or 4 slots for media modules (modules 1-2 or 1-4) that are hot-swappable and each provide 8 Fast ETHERNET/Gigabit ETHERNET ports. The media modules differ with regard to the number of interfaces and the media type for connecting segments.

The integrated basic board is located below the modules.
It is equipped as follows:

- The MACH 4002-48+4G has 4 Gigabit ETHERNET ports (comboports, i.e. SFP slots for 1000BASE-SX or 1000BASE-LX and RJ45 sockets for 10/100/1000BASE-TX, module 5) and 16 Fast ETHERNET ports (10/100BASE-TX, module 6).
- The MACH 4002-24G has 8 Gigabit ETHERNET ports (SFP slots for 100BASE-FX, 1000BASE-SX/LXm module 6, alternatively to the RJ45 ports 6.1 to 6.8) and 8 Gigabit ETHERNET RJ45 ports (10/100/1000BASE-TX, module 6).
- The MACH 4002-48G has 8 Gigabit ETHERNET ports (SFP slots for 100BASE-FX, 1000BASE-SX/LXm module 6, alternatively to the RJ45 ports 6.1 to 6.8) and 16 Gigabit ETHERNET RJ45 ports (10/100/1000BASE-TX, module 6).
- The MACH 4002-24G+3XP has three 10-Gigabit ETHERNET ports (XFP slots for 10GBASE-SR/LR, module 5) and 8 Gigabit ETHERNET RJ45 ports (10/100/1000BASE-TX, module 6).
- The MACH 4002-24G+3XP has three 10-Gigabit ETHERNET ports (XFP slots for 10GBASE-SR/LR, module 5) and 16 Gigabit ETHERNET RJ45 ports (10/100/1000BASE-TX, module 6).

Along with the 10-Gigabit (if present), Gigabit and Fast ETHERNET ports, the front of the basic board also has the following connections:

- A USB socket for connecting an ACA21-USB AutoConfiguration Adapter
- A V.24 socket for the network management connection

- Two signal contacts that are integrated together on one socket

The LED display block on the left side of the basic board informs you about the status of the device. You use the SELECT button to define the meaning of the LED displays.

At the front left of the basic chassis of the MACH 4000, there is a replaceable plug-in fan.

On the back of the device there is a slot for a power supply unit:
- AC plug-in power unit 300W
- 24 VDC plug-in power unit 300W (2 connections coupled via diodes)
- 48 VDC plug-in power unit 300W (2 connections coupled via diodes)

The back of the device also has two external inputs
(voltage input Nos. 3 + 4) for the redundant voltage supply via the M4-POWER power unit chassis.

The M4-POWER power unit chassis enables redundant power supply. The power supply cable(s) between M4-POWER and MACH 4000 are connected at the back of the MACH 4000 device.
M4-POWER provides you with 3 slots for plug-in power units:
- AC plug-in power unit 300W
- 24 VDC plug-in power unit 300W (2 connections coupled via diodes)
- 48 VDC plug-in power unit 300W (2 connections coupled via diodes)

1.2 Power supply

On the back of the device there is a slot for a power supply unit (AC or DC) and two inputs for the redundant power supply via the M4-POWER power unit chassis.

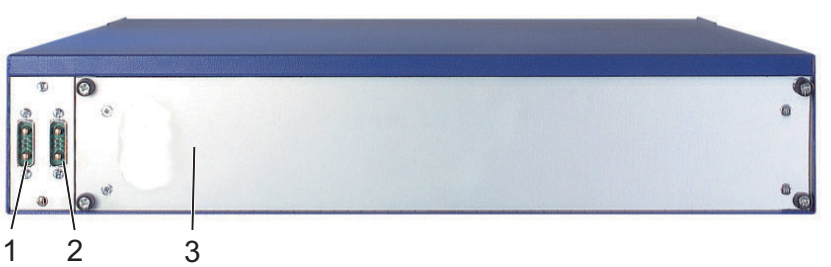


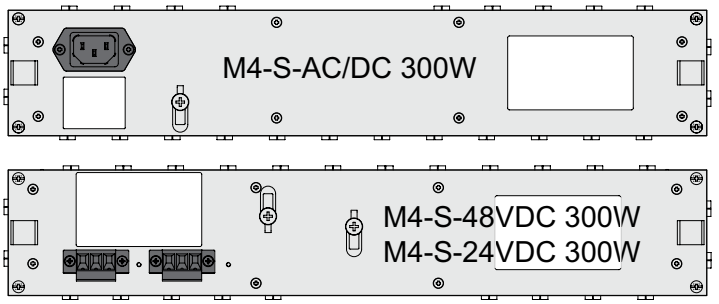
Figure 7: Back side of the MACH 4000 basic device
1 - M4-POWER connection (voltage input no. 4, external)
2 - M4-POWER connection (voltage input no. 3, external)
3 - Slot for slide-in power supply unit
(voltage input no. 1 and, if required, no. 2)

1.2.1 Power supply on back of device

- **Plug-in power units for MACH 4000 switch chassis**
  - M4-S-AC/DC 300W
  - M4-S-24VDC 300W, 2 inputs for redundant power supply
  - M4-S-48VDC 300W, 2 inputs for redundant power supply

  (see on page 52 „Order numbers/product description“)

  Note: The plug-in power units of the M4-POWER power unit chassis cannot be used for the switch chassis.



1.2.2 M4-POWER power unit chassis

The M4-POWER power unit chassis enables redundant power supply. It has three slots for plug-in power units. The plug-in power units can be replaced during operation (hot-swappable).

Depending on the plug-in power units connected, you can use an M4-POWER power unit chassis to implement the redundant power supply for several MACH 4000 devices.

☐ You connect the M4-POWER power units to the M4-POWER connection on the back of the MACH 4000 device using the power supply cable supplied with the M4-P-xx plug-in power units.

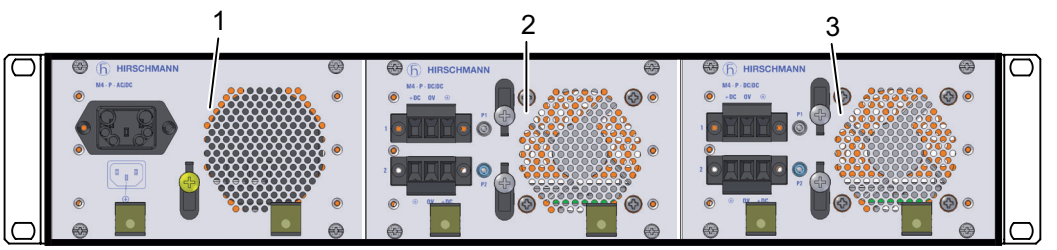


Figure 8: M4-POWER power unit chassis, front side of the device (mounting with up to 3 power units)
1 - Power unit 1
2 - Power unit 2
3 - Power unit 3

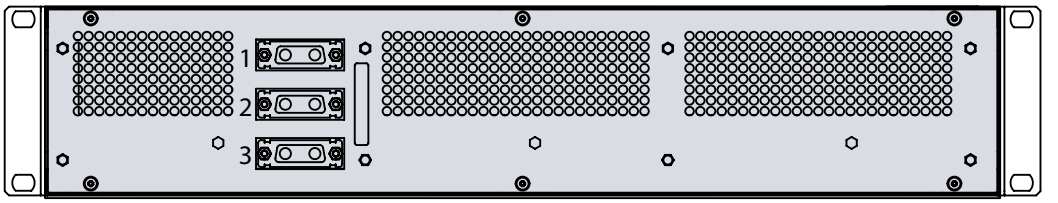


Figure 9: M4-POWER power unit chassis, back side of the device

- **Plug-in power units for M4-POWER power unit chassis**
  - M4-P-AC/DC 300W
  - M4-P-24VDC 300W, 2 inputs for redundant power supply
  - M4-P-48VDC 300W, 2 inputs for redundant power supply

  (see on page 52 „Order numbers/product description“).

  Note: The plug-in power units of the M4-POWER power unit chassis cannot be used for the switch chassis.

1.3 Fan

1.3.1 M4-AIR plug-in fan

MACH 4000 switch racks are only for use with fan units as follows.
The M4-AIR or M4-AIR-L plug-in fan is located on the left of the front side of the MACH 4002 chassis. You can replace the plug-in fan during operation (see on page 40 „Replacing the M4-AIR... plug-in fan unit“).

- **M4-AIR**: Plug-in fan for MACH 4000 switch chassis without temperature sensor for use in ambient temperatures up to a maximum of +60 °C.
- **M4-AIR-L**: Plug-in fan for MACH 4000 switch chassis with reduced fan speed for use in ambient temperatures up to a maximum of +40 °C.

Note: Devices with the M4-AIR-L plug-in fan are suitable for use in an ambient temperature up to a maximum of +40 °C.

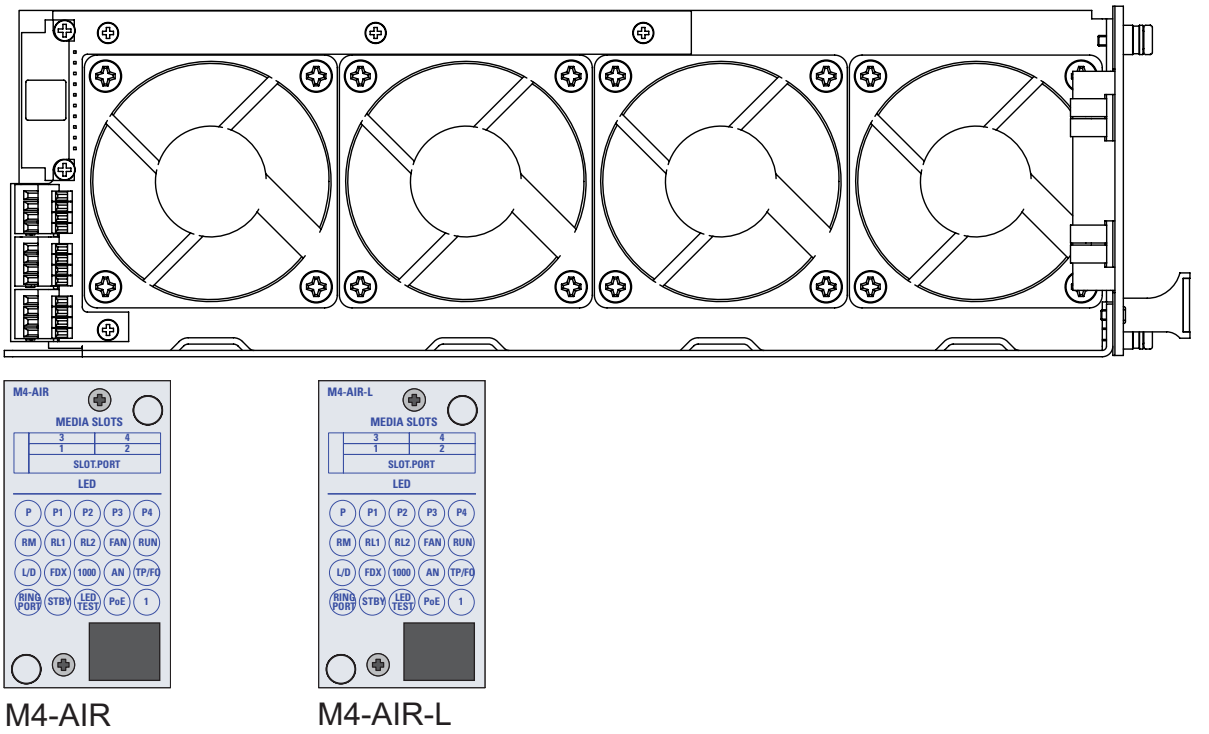


Figure 10: M4-AIR and M4-AIR-L plug-in fans
Side and front views

1.3.2 Monitoring temperature and fan

Fan monitoring

Every individual fan sends a speed-dependent signal to the basic system. The fan monitoring displays the failure of one or more individual fans.

The effect of insufficient ventilation

If the device is insufficiently ventilated by its fans, this either causes the assemblies to age faster (MTBF value) or triggers error statuses, and it usually leads to transmission errors on the Ethernet connections.

Temperature difference

The difference between the ambient temperature and the circuit board (PCB) temperature is primarily dependent on the ambient temperature:

MACH 4000 device	Ambient - PCB temperature difference at full speed for all fans	Ambient - PCB temperature difference at half speed for all fans
MACH4002-48+4G	15 °K	20 °K
MACH4002-24G/48G	20 °K	27 °K

Table 2: Ambient - PCB temperature difference at full and half fan speed

Recommendation for temperature monitoring

Use the following table (based on half speed for all fans) to monitor the temperature of your device.

Switch the device off if the temperature values entered in the table are exceeded. This ensures that the device is sufficiently ventilated and is not operated at its limit.

MACH 4000 device	PCB temperature threshold value
MACH4002-48+4G	Ambient temperature + 20 °K
MACH4002-24G/48G	Ambient temperature + 27 °K

Table 3: Temperature monitoring

1.4 Integrated basic board

Depending on the device variant, the integrated basic board provides you with different numbers and types of port (see table 116 „Maximum number of ports and media modules and maximum PoE power“), “Number of installed ports (basic board)” column.

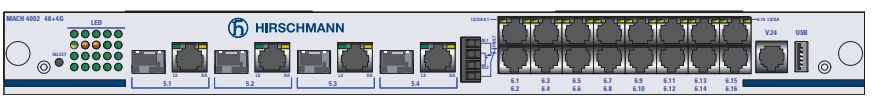


Figure 11: Basic board MACH 4002-48+4G

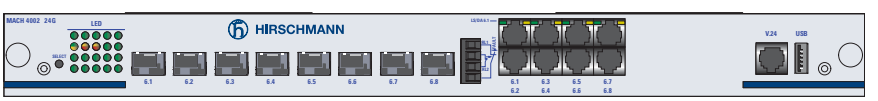


Figure 12: Basic board MACH 4002-24G

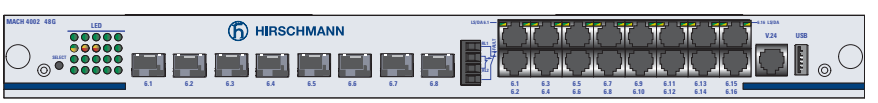


Figure 13: Basic board MACH 4002-48G

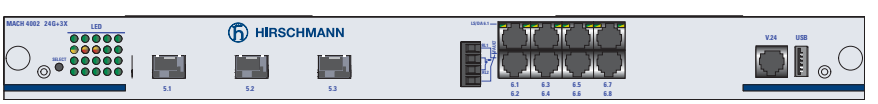


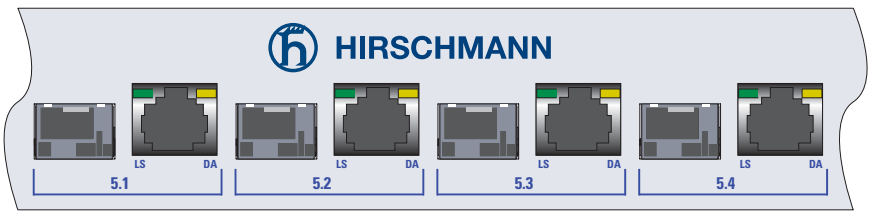
Figure 14: Basic board MACH 4002-24G+3X

Figure 15: Basic board MACH 4002-48G+3X

1.4.1 Left area of basic board

- **Four Gigabit ETHERNET ports (combo) in MACH 4002-48+4G**

  There are four Gigabit ETHERNET ports (ports number 5.1 to 5.4) for connecting network segments on the left side of the basic board. The ports are RJ45 sockets, each with two integrated LEDs and an SFP slot.

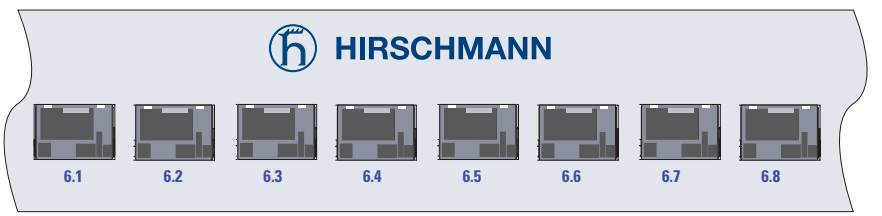


  If an SFP plug-in module is mounted, the RJ45 socket is switched off. The LEDs each apply to the active port. You can use the SELECT button to test the TP or FO connections.

  Order numbers for SFP plug-in modules: (see on page 52 „Order numbers/product description“).

- **Eight Gigabit ETHERNET ports (combo) in MACH 4002-24G and MACH 4002-48G**

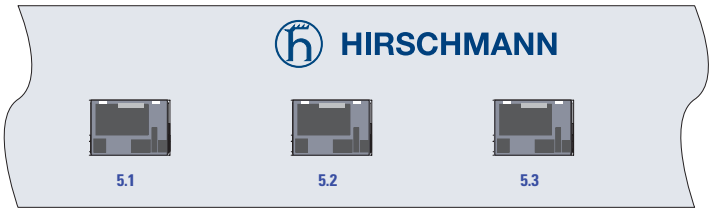
  There are eight Gigabit ETHERNET ports (ports number 6.1 to 6.8) for connecting network segments on the left side of the basic board. These are SFP slots that are used as alternatives to RJ45 ports 6.1 to 6.8.



  Order numbers for SFP plug-in modules: (see on page 52 „Order numbers/product description“).

Three 10-Gigabit ETHERNET ports (XFP) in MACH 4002-24G+3X and MACH 4002-48G+3X

There are three 10-Gigabit ETHERNET ports (ports number 5.1 to 5.3) for connecting network segments on the left side of the basic board. These ports are XFP slots.



The following XFP plug-in modules (10-Gigabit ETHERNET SFP transceivers) are available to you for the MACH 4002-...-3X:

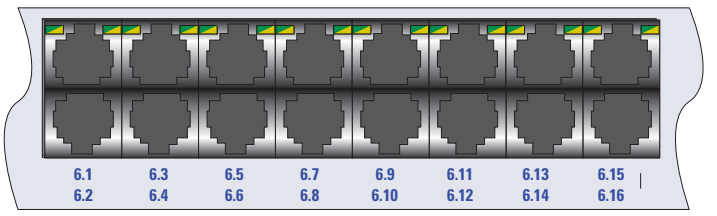
- M-XFP-SR/LC
- M-XFP-LR/LC
- M-XFP-ER/LC
- M-XFP-ZR/LC

Order numbers for XFP plug-in modules: (see on page 52 „Order numbers/product description“).

1.4.2 Right area of basic board

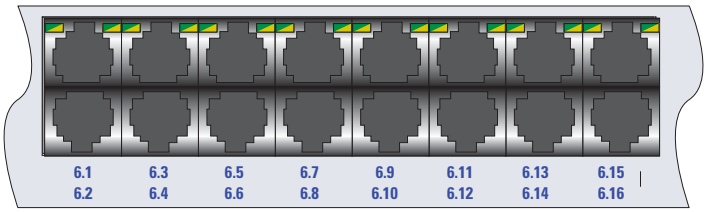
16 Fast ETHERNET ports in MACH 4002-48+4G

There are 16 * 10/100BASE-TX ports (ports number 6.1 to 6.16) for connecting network segments on the right side of the basic board. These ports are RJ-45 connections.



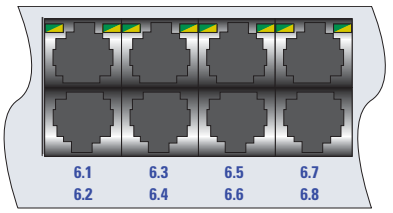
16 Gigabit ETHERNET ports in MACH 4002-48G and MACH 4002-48G+3X

There are 16 * 10/100/1000BASE-TX ports (ports number 6.1 to 6.16) for connecting network segments on the right side of the basic board. These ports are RJ-45 connections.
In the MACH 4002-48G, the RJ45 ports 6.1 to 6.8 can be used as alternatives to the SFP ports 6.1 to 6.8 on the left side of the basic board (combo ports).



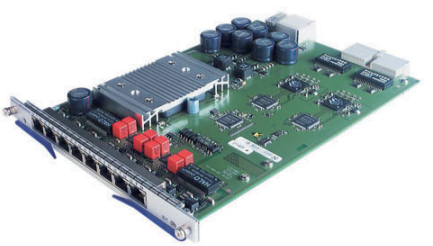
- **8 Gigabit ETHERNET ports in MACH 4002-24G and MACH 4002-24G+3X**

  There are 8 * 10/100/1000BASE-TX ports (ports number 6.1 to 6.8) for connecting network segments on the right side of the basic board. These ports are RJ-45 connections.
  In the MACH 4002-24G, the RJ45 ports 6.1 to 6.8 can be used as alternatives to the SFP ports 6.1 to 6.8 on the left side of the basic board (combo ports).

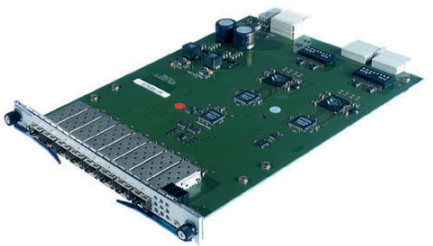


1.5 Media modules

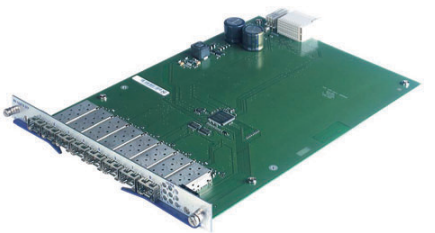
M4-8TP-RJ45



M4-FAST 8TP-RJ45-PoE



M4-FAST 8-SFP



M4-GIGA 8-SFP

Figure 16: Fast ETHERNET and Gigabit ETHERNET media modules

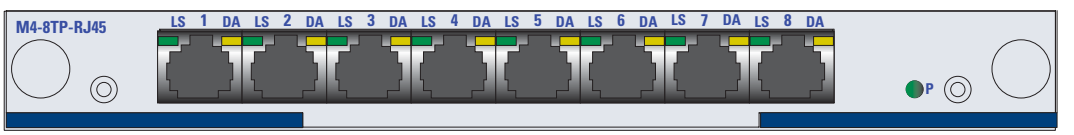
MACH 4000 device	M4-8TP-RJ45	M4-FAST 8TP-RJ45-PoE	M4-FAST 8-SFP	M4-GIGA 8-SFP
MACH 4002-48+4G	0 - 4 modules	0 - 4 modules [a]	0 - 4 modules	0 modules
MACH 4002-24G...	0 - 2 modules	0 - 2 modules [1]	0 - 2 modules	0 - 2 modules
MACH 4002-48G...	0 - 4 modules	0 - 4 modules [1]	0 - 4 modules	0 - 4 modules

Table 4: Possible media module usage in MACH 4000 devices

a. Note the PoE capacity limits (see table 16 „Maximum number of ports and media modules and maximum PoE power“)

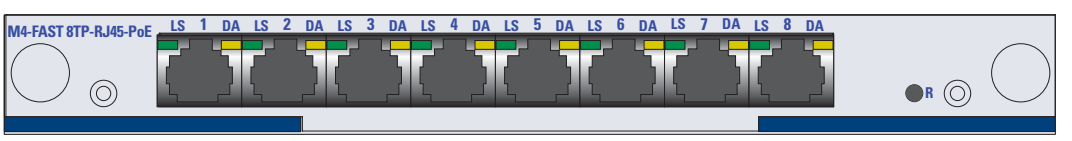
1.5.1 M4-8TP-RJ45

The M4-8TP-RJ45 media module provides you with eight 10/100BASE-TX ports (RJ-45 connections) for connecting network segments.



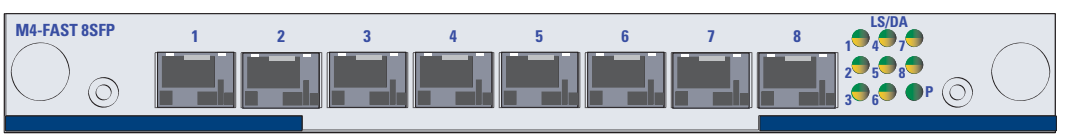
1.5.2 M4-FAST 8TP-RJ45-PoE

The M4-FAST 8TP-RJ45 PoE media module provides you with eight 10/100BASE-TX ports (RJ-45 connections) for connecting network segments. It supports Power over ETHERNET on data lines in compliance with IEEE 802.3af.
The maximum power available to you for all ports combined for PoE applications is listed in the table above (see table 16 „Maximum number of ports and media modules and maximum PoE power“).
Up to four M4-FAST 8TP-RJ45 PoE modules can be used for each basic device. The number of ports supplying PoE terminal devices with power depends on the total power available. The power is supplied via the data lines. The individual ports are not electrically insulated from each other.



1.5.3 M4-FAST 8-SFP

The M4-FAST 8-SFP media module has eight 100BASE-FX ports (SFP slots for mounting SFP modules).



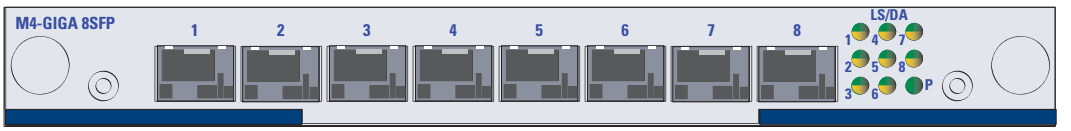
The following SFP plug-in modules (Fast ETHERNET SFP transceiver) are available for the M4-FAST 8-SFP media module:

- M-FAST SFP-MM/LC
- M-FAST SFP-SM/LC
- M-FAST SFP-SM+/LC
- M-FAST SFP-LH/LC

Order numbers for SFP plug-in modules: (see on page 52 „Order numbers/ product description“).

1.5.4 M4-GIGA 8-SFP

The M4-GIGA 8-SFP media module has eight 100/1000BASE-FX ports (SFP slots for mounting SFP modules).



The following SFP plug-in modules are available for the M4-GIGA 8-SFP media module: Gigabit ETHERNET SFP transceiver:

- Gigabit ETHERNET SFP transceiver:
  - M-SFP-SX/LC
  - M-SFP-LX/LC
  - M-SFP-LH+/LC
  - M-SFP-LH+/LC
- Fast ETHERNET SFP transceiver:
  - M-FAST SFP-MM/LC
  - M-FAST SFP-SM/LC
  - M-FAST SFP-SM+/LC
  - M-FAST SFP-LH/LC

Order numbers for SFP plug-in modules: (see on page 52 „Order numbers/ product description“).

2 Assembly and start-up

The devices have been developed for practical application in a harsh industrial environment. The installation process is correspondingly simple.

On delivery, the device is ready for operation.
The following procedure has been proven to be successful for the assembly of the device:

- Unpacking and checking
- Installing the media modules
- Installing the SFP/XFP modules
- Installing the power supply unit on the back of the device
- Installing the plug-in power units in the M4-POWER power unit chassis
- Setting up/mounting the device in the 19" rack
- Grounding the device
- Assembling the power unit chassis, connecting with the MACH 4000
- Connecting the terminal block for signal contact
- Connecting the supply voltage, starting up
- Installing the data lines

2.1 Installing the device

2.1.1 Unpacking and checking

☐ Check whether the contents of the package are complete (see page 52 „Scope of delivery“).
☐ Check the individual parts for transport damage.

2.1.2 Installing the media modules

The switch has four inputs for connecting media modules.

The number of connectable network segments depends on the number of media modules installed. If the full four media modules with 8 ports each are connected, then in addition to the ports of the basic board, you get a further 32 ports for connecting network segments.
The modular design of the device allows you to easily expand the network yourself by installing the desired media modules.
The media modules can be installed in the devices, or deinstalled, while the network is operating (hot-swappable).

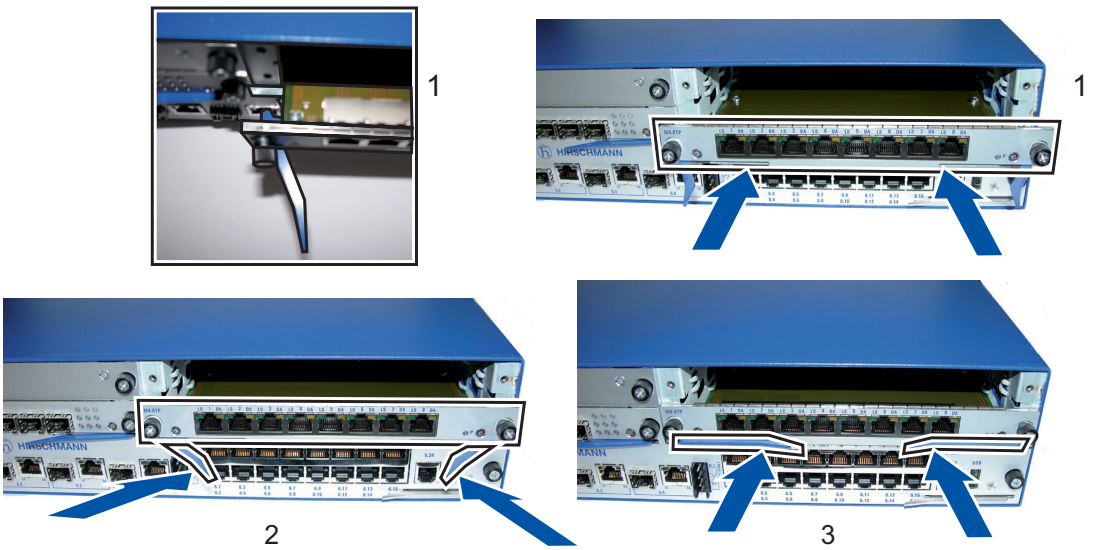


Figure 17: Installing the media modules
1 - Step 1
2 - Step 2
3 - Step 3

- ☐ Note the ESD guidelines on page 10 and the safety instructions on page 5.
- ☐ Close the whole of the front surface beside the media modules with cover panels. This provides optimal shielding and convection. The slots for the media modules are all the same. They can be selected in any order.
- ☐ Remove the cover panel to insert the media module.
- ☐ Note the positions of the blue insertion catches (see Fig. above, step 1)
- ☐ Insert the media module almost as far as it will go into the desired slot (see Fig. above, step 2).
- ☐ Make sure that there is a good connection between the multiple plugs of the media module and the female multipoints of the system bus.
- ☐ Insert the media module as far as it will go into the desired slot by closing the blue insertion catches. (See Fig. above, step 3).
- ☐ Screw the two knurled screws in the front panel of the media module flush with the frame of the basic device.

2.1.3 Installing the SFP/XFP modules

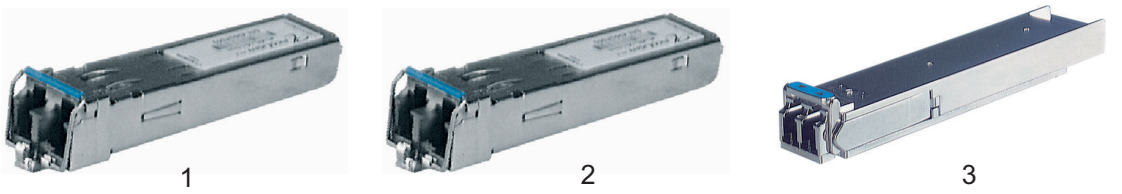


Figure 18: SFP and XFP modules
1 - Fast ETHERNET fiberoptic SFP module
2 - Gigabit ETHERNET fiberoptic SFP module
3 - 10 Gigabit ETHERNET fiberoptic XFP module

☐ Before attaching an SFP or XFP module, first remove the protective cap of the SFP/XFP module.
☐ Push the SFP/XFP module with the lock closed into the socket until it latches audibly in place.

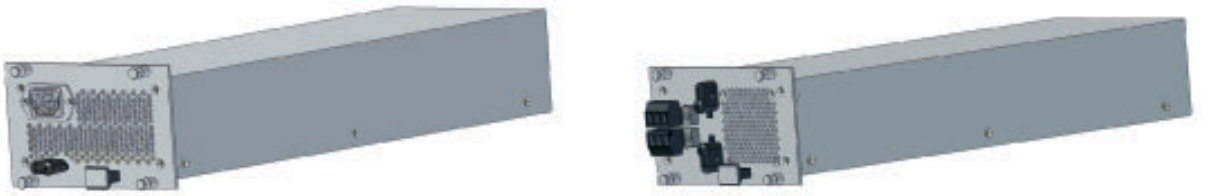
Note: Only use Hirschmann SFP/XFP modules (see on page 53 „Accessories“).

2.1.4 Installing the power supply unit on the back of the device

☐ Remove the cover panel.
☐ Slide the power supply unit all the way into the basic device along the mounting rails above and below.
☐ Make sure that there is a good connection between the multiple plug of the plug-in power unit and the female multipoint of the system bus.

☐ Screw the four slotted-head screws in the front panel of the plug-in power unit flush with the frame of the basic device.

2.1.5 Installing the plug-in power units in the M4-POWER power unit chassis



When replacing a defective plug-in power unit, only use a plug-in power unit of the M4-P-... 300W type. (see on page 52 „Order numbers/product description“).

☐ Remove the mains voltage supply line.
☐ Loosen the four screws used to fasten the plug-in power unit in the basic device and pull the unit out of the basic device, or remove the cover plate of the power unit slot.
☐ Slide the new plug-in power unit all the way into the basic device along the mounting rails above and below.
☐ Make sure that there is a good connection between the multiple plug of the plug-in power unit and the female multipoint of the system bus.
☐ Screw the slotted-head screws in the front panel of the plug-in power unit flush with the frame of the basic device.
☐ Connect the mains voltage supply line.

Note: The tightening torque is
- 7 lb in. (0.791 Nm) for input connections.
- 11 lb in. (1.243 Nm) for all field wiring terminal blocks.

2.1.6 Setting up/mounting the basic switch device in the 19" rack

Setting up

Using the basic device as a table device:

☐ Attach the rubber feet supplied with the device to the bottom of the device.
  – First remove the protective film from the adhesive film of the rubber feet.
  – Attach one rubber foot approximately 2 cm from each corner of the device.

  Note: The adhesive surface should be free of dust and grease.

Dimension drawings

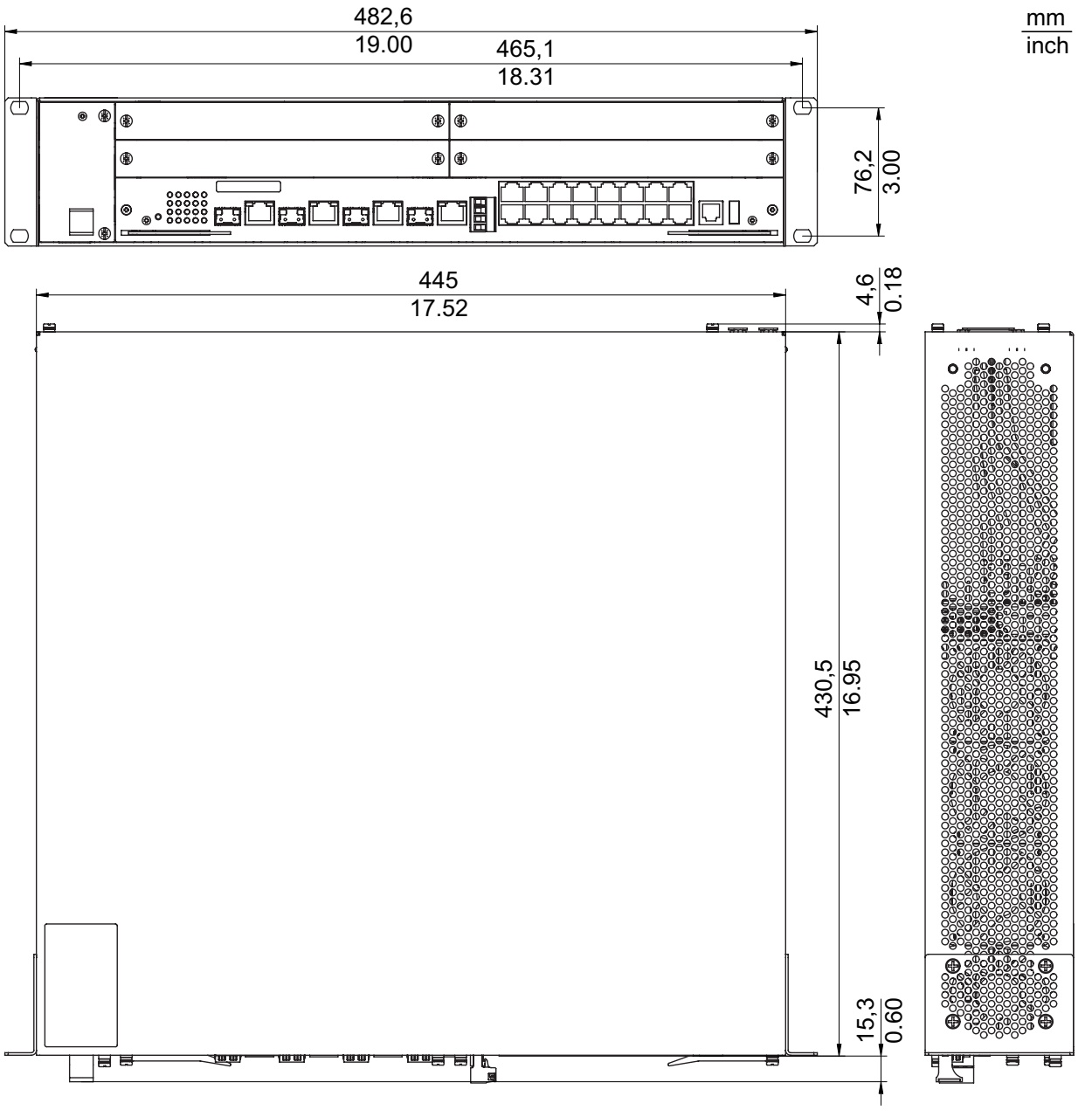


Figure 19: Dimensions

Installation

The devices are designed to be mounted in a 19" rack.

- ☐ Make sure there is sufficient ventilation. If necessary, provide a fan for the 19" rack. This will prevent the basic devices from overheating.
- ☐ Measure the depth of the 19" rack so as to allow the main cable, and any power supply cables, to be fitted from the back, and the data cables to be fitted from the front.

If you are operating the device in a 19" switch cabinet, you must install sliding/mounting rails (not included in the delivery) to hold the weight of the device.

Warning
If the device is installed in a 19" switch cabinet without sliding/mounting rails, increased vibration can cause damage to the device and/or its modules.

For more information on sliding/mounting rails and how to install them, please contact your switch cabinet manufacturer.

☐ Install the sliding/mounting rails in the 19" switch cabinet as instructed by the manufacturer, and make sure the device is resting on both rails.

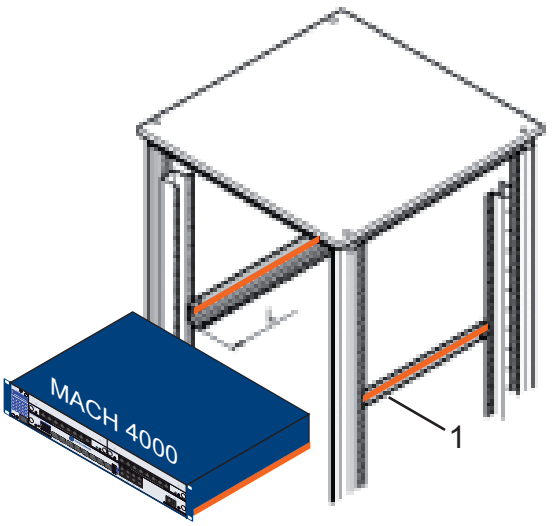
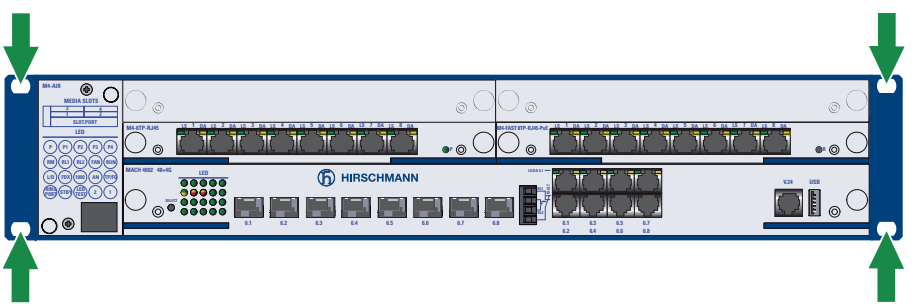


Figure 20: Mounting in a 19" rack
1 - Chassis runner

On delivery, two brackets are attached to the sides of the device (see figure below).



☐ Fasten the device by screwing the brackets to the switch cabinet.

Warning
When installing the device, make sure the ventilation slots remain unobstructed, as otherwise the device can overheat and be damaged.

2.1.7 Grounding the device

The device is grounded via the power supply connections.

Note: The shielding ground of the connectable twisted pairs lines is connected to the front panel as a conductor.
When the device is being operated via the 230/120 VAC power supply unit, it is grounded via the safety plug. When it is being operated with external DC voltage via the
M4-POWER connections, the device is grounded via the M4-POWER connection.

2.1.8 Mounting the power unit chassis, connecting it with the MACH 4000

☐ Connect the basic switch device and the M4-POWER power unit chassis with the mounting angle included in the delivery.

☐ For the redundant power supply, you use the power supply cable to connect the power unit(s) in the M4-POWER power unit chassis with the M4-POWER connection on the back of the MACH 4000 device.

Warning
The power supply cables between the M4-POWER power unit chassis and the MACH 4000 are not hot-swappable. Note the sequence for connecting the cables: First connect the power supply cable(s) between M4-POWER and MACH 4000. Then connect the power supply (AC or DC, depending on the plug-in power unit) for the M4-POWER.

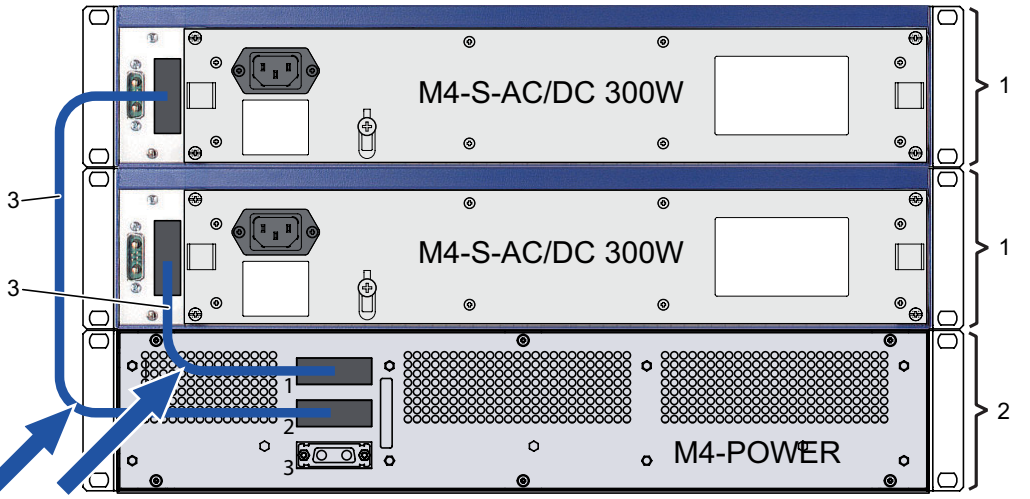


Figure 21: Redundant power supply via the M4-POWER power unit chassis, Step 1: Connecting the MACH 4000 device(s) to the M4-POWER
1 - MACH 4000, back side of the device
2 - M4-POWER power unit chassis, back side of the device
3 - not hot swapable

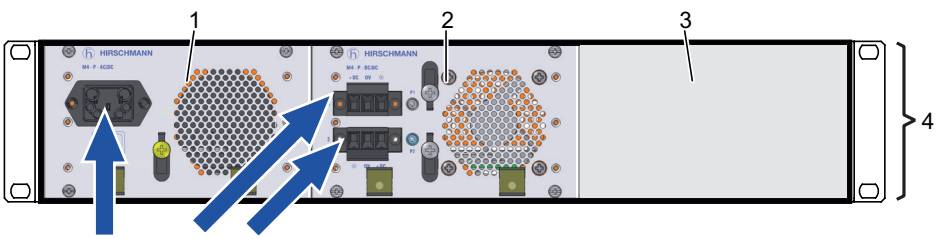


Figure 22: Redundant power supply via the M4-POWER power unit chassis, Step 2: Connecting the power supply to the M4-POWER (Example: two power units mounted)
1 - Power unit 1
2 - Power unit 2
3 - Not mounted
4 - M4-POWER power unit chassis, front side of the device

2.1.9 Connecting the terminal block for signal contact

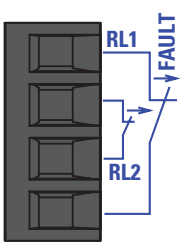


Figure 23: 4-pin signal contact

- The signal contact (“FAULT”) monitors the functions of the device, thus enabling remote diagnostics. You can specify the type of function monitoring in the Management.
- You can also use the Management to switch the signal contact manually and thus control external devices.

A break in contact is used to report the following conditions via the potential-free signal contact (relay contact, closed circuit):
- The failure of at least one supply voltage.
- A continuous malfunction in the device.
- The loss of connection at at least one port. The report of the link status can be masked by the Management for each port. In the delivery state, link status monitoring is deactivated.
- The loss of ring redundancy reserve.
- A detected error during the self-test.

The following conditions are reported in standby mode:
- Control cable interrupted
- Control cable short-circuited
- Partner device is in standby mode

The following conditions are reported in normal mode:
- Control cable short-circuited
- Partner device is in normal mode

The following condition is also reported in RM mode:
- Ring redundancy reserve is available. On delivery, there is no ring redundancy monitoring.

☐ Pull the terminal block off the Switch and connect the signal lines.

☐ Mount the terminal block for the two signal contacts on the front of the device. Make sure that the snap lock snaps into place.

2.1.10 Connecting the supply voltage, starting up

☐ The devices may only be connected to the supply voltage specified on their type plate. Connect the mains cable, then connect this to the mains voltage. Make sure the cable is not under strain.

Warning: The DC modules (M4-...-...VDC 300W) are designed for operation with safety extra-low voltage. Accordingly, only PELV or SELV circuits with voltage restrictions in line with IEC/EN 60950-1 may be connected to the supply voltage connections.

The external supply voltage can be connected redundantly (see on page 18 „Power supply“). Both inputs are uncoupled.
With redundant supply, the power supply unit with the higher output voltage supplies the device on its own. The supply voltage is electrically isolated from the housing.

The DC modules (M4-...-...VDC 300W) are grounded via the 3-pin DC socket connection.

Switch on the plug-in power units to start up the device.

Note: With non-redundant supply of the main voltage, the device reports a loss of power. You can avert this message by applying the supply voltage via both inputs, or by changing the configuration in the Management.

Note: The 0V connections within a DC module (M4-...-...VDC 300W) are connected with each other.

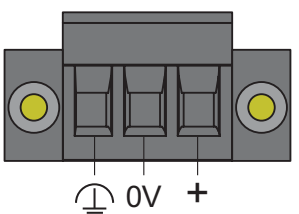


Figure 24: Plug connections at the DC socket (external voltage supply)

2.1.11 Connecting the data lines

You can connect terminal devices and other segments at the ports of the device via twisted pair cables and F/O cables.

☐ Install the data lines according to your requirements.

10/100 Mbit/s twisted pair connection

10/100 Mbit/s ports (RJ45 socket) enable the connection of terminal devices or independent network segments according to the IEEE 802.3 100BASE-TX / 10BASE-T standard.
These ports support:

- Autonegotiation
- Autopolarity
- Autocrossing (if autonegotiation is activated)
- 100 Mbit/s half-duplex mode, 100 Mbit/s full duplex mode
- 10 Mbit/s half-duplex mode, 10 Mbit/s full duplex mode

State on delivery: autonegotiation activated.
The socket housing is electrically connected to the front panel.

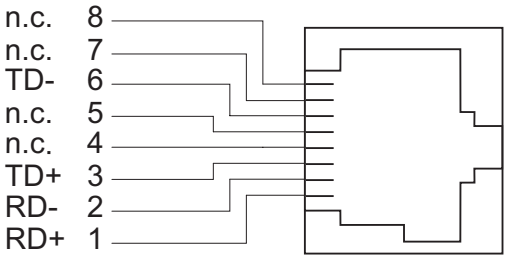


Figure 25: Pin assignment of a TP/TX interface in MDI-X mode, RJ45 socket

10/100 Mbit/s twisted pair connection PoE

10/100 Mbit/s ports (RJ45 socket) enable the connection of terminal devices or independent network segments according to the IEEE 802.3 100BASE-TX / 10BASE-T and IEEE 802.3af (Power over ETHERNET on data lines) standards. These ports support:

- Autonegotiation
- Autopolarity
- Autocrossing (if autonegotiation is activated)
- 100 Mbit/s half-duplex mode, 100 Mbit/s full duplex mode
- 10 Mbit/s half-duplex mode, 10 Mbit/s full duplex mode
- Power over ETHERNET. The maximum power available to you for all ports combined for PoE applications is listed in the table above (see page 18 „Power supply“).

State on delivery: autonegotiation activated.
The socket housing is electrically connected to the front panel.
The PoE voltage is input via the wire pairs transmitting the signal (phantom voltage).

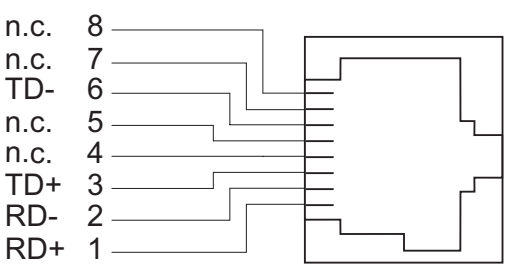


Figure 26: Pin assignment of a TP/TX interface in MDI-X mode, RJ45 socket

10/100/1000 Mbit/s twisted pair connection

10/100/1000 Mbit/s twisted pair ports (RJ45 socket) enable the connection of terminal devices or independent network segments according to the IEEE 802.3-2000 (ISO/IEC 8802-3:2000) 10BASE-T, 100BASE-TX and 1000BASE-T standards.
These ports support:

- Autonegotiation
- Autopolarity
- Autocrossing (if autonegotiation is activated)

- 1000 Mbit/s full duplex
- 100 Mbit/s half-duplex mode, 100 Mbit/s full duplex mode
- 10 Mbit/s half-duplex mode, 10 Mbit/s full duplex mode

State on delivery: autonegotiation.
The socket housing is electrically connected to the front panel.
The pin assignment corresponds to MDI-X.

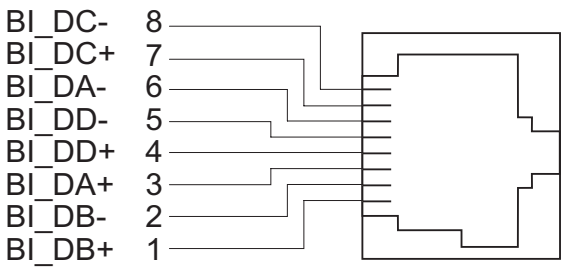


Figure 27: Pin assignment of the 1000 Mbit/s twisted pair interface

100 Mbit/s F/O connection

100 MBit/s F/O ports (SFP slot) enable the connection of terminal devices or independent network segments in compliance with the IEEE 802.3 100BASE-FX standard. These ports support:

- Full duplex mode

State on delivery: full duplex FDX

Note: Make sure that the LH ports are only connected with LH ports, SM ports are only connected with SM ports, and MM ports only with MM ports.

1 Gbit/s fiber optic connection

1 GBit/s fiber optic ports (SFP slot) enable the connection of terminal devices or independent network segments in compliance with the IEEE 802.3-2000 (ISO/IEC 8802-3:2000) 1000BASE-SX or 1000BASE-LX standards. These ports support:

- Autonegotiation
- Full duplex mode

Default settings: autonegotiation

Note: Make sure that the LH ports are only connected with LH ports, SX ports are only connected with SX ports, and LX ports only with LX ports.

10 Gbit/s F/O connection

10 GBit/s F/O ports (XFP slot) enable the connection of terminal devices or independent network segments in compliance with the IEEE 802.3ae-2002 (ISO/IEC 8802-3:2002) 10GBASE-SR/LR standard. These ports support:

- Full duplex mode

State on delivery: full duplex FDX

Note: Make sure that the SR ports are only connected with SR ports, LR ports are only connected with LR ports, ER ports only with ER ports, and ZR ports only with ZR ports.

2.1.12 Replacing the M4-AIR... plug-in fan unit

The plug-in fan unit (M4-AIR or M4-AIR-L) is replaceable. It may be replaced by an electrician without turning off the device. Depending on the ambient temperature, the device can be operated for a maximum of one to two minutes with the fan unit removed.

Deinstalling the M4-AIR... plug-in fan unit

☐ Remove the two screws in the front panel of the M4-AIR or M4-AIR-L plug-in fan unit.
Caution: After the device is switched off, the fan blades continue rotating for a number of seconds. Do not reach into a rotating fan!

☐ Pull the plug-in fan unit out a few centimeters and wait until the fan comes to a halt before pulling it all the way out.

Installing the M4-AIR... plug-in fan unit

☐ Deinstall the M4-AIR or M4-AIR-L plug-in fan unit to be replaced as described above.

☐ Slide the new plug-in fan unit all the way into the basic device along the mounting rails above and below.

☐ Make sure that there is a good connection between the multiple plug of the plug-in fan unit and the female multipoint of the system bus.

☐ Screw the two knurled screws in the front panel of the plug-in fan unit with the frame of the basic device.

2.2 Display elements

After the operating voltage is set up, the software starts and initializes itself. Afterwards, the device performs a self-test. During this process, various LEDs light up. The process takes around 60 seconds.

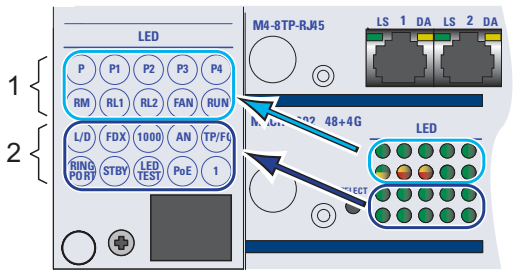


Figure 28: Display elements for device state and port display state
1 - Device state
2 - Port display state

Device state

These LEDs provide information about conditions which affect the operation of the whole device.

P- Power (green LED)	
Glowing green	Internal supply voltage present.
Not glowing	Internal supply voltage is too low.
P1 - Power 1 (green LED)	
Glowing green	Supply voltage 1 is present at the plug-in power unit.
Not glowing	No supply voltage 1, or voltage too low, at plug-in power unit.
Flashing green	Voltage supply 1 is present, but plug-in power unit is reporting an error.
P2 - Power 2 (green LED)	
Glowing green	Supply voltage 2 is present at the plug-in power unit.
Not glowing	No supply voltage 2, or voltage too low, at plug-in power unit.
Flashing green	Voltage supply 2 is present, but plug-in power unit is reporting an error.
P3 - Power 3 (green LED)	
Glowing green	Supply voltage 3 is present at external input 3
Not glowing	No supply voltage 3, or voltage too low, at external input 3
Flashing green	Voltage supply 3 is present, but plug-in power unit is reporting an error.
P4 - Power 4 (green LED)	
Glowing green	Supply voltage 4 is present at external input 4
Not glowing	No supply voltage 4, or voltage too low, at external input 4
Flashing green	Voltage supply 4 is present, but plug-in power unit is reporting an error.
RM - Ring Manager (green/yellow LED)	
Glowing green	RM function active, redundant port disabled
Glowing yellow	RM function active, redundant port enabled

RM - Ring Manager (green/yellow LED)	
Not glowing	RM function not active
Flashing green	Incorrect configuration of the HIPER-Ring (e.g. the ring is not connected to the ring port).
RL1 - Relay 1, signal contact (red/yellow LED)	
Glowing red	Signal contact 1 is open, i.e. it is reporting an error.
Glowing yellow	Signal contact 1 is open, the “Manual Setting” is active
Not glowing	Signal contact 1 is closed, i.e. it is not reporting an error, or it was closed via the “Manual Setting”.
RL2 - Relay 2, signal contact (red/yellow LED)	
Glowing red	Signal contact 2 is open, i.e. it is reporting an error.
Glowing yellow	Signal contact 2 is open, the “Manual Setting” is active
Not glowing	Signal contact 2 is closed, i.e. it is not reporting an error, or it was closed via the “Manual Setting”.
FAN - overall fan status (green/yellow LED)	
Glowing green	The plug-in fan unit is installed, and no fan is reporting an error.
Not glowing	The plug-in fan unit is installed and at least one fan is reporting an error, or the plug-in fan unit is not installed.
RUN - BOOT/RUN (green/yellow LED)	
Glowing green	System is ready for operation.
Flashing green	System is booting.
Not glowing	System is in reset mode.

Port status

Every media module has one LED per port. The meaning of this port status LED depends on the setting on the basic device. You define the display meaning with the “SELECT” button on the basic device.

☐ Press the button for approx. 2 seconds to change the meaning of the display. If the button is not pressed for approx. 20 seconds, the display status changes back to “L/D”.

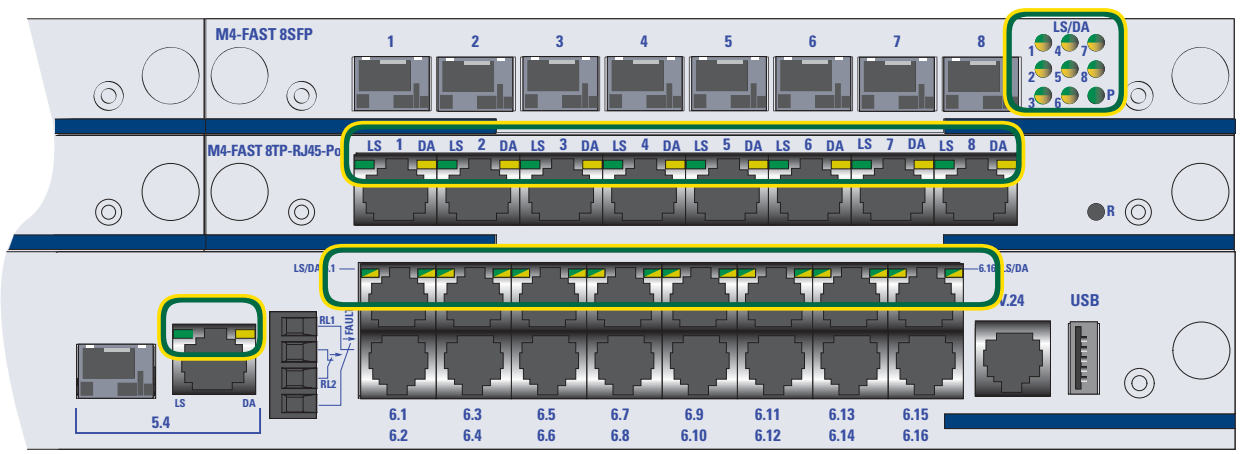
L/D - data, link status (green LED)	
Glowing green	The port LEDs of the media modules display the connection status.
FDX - full duplex (green LED)	
Glowing green	The port LEDs of the media modules display the half-duplex or full-duplex connection status.
1000 - 10/100/1000 Mbit/s (green LED)	
Glowing green	The port LEDs of the media modules display the set transmission speed.
AN - autonegotiation (green LED)	
Glowing green	The port LEDs of the media modules display the port configuration type.

RING PORT - Ring port (green LED)	
Glowing green	The port LEDs of the media modules display the HIPER-Ring assignment.
STBY - stand-by (green LED)	
Glowing green	The port LEDs of the media modules display the assignment to a redundant coupling of network segments.
LED TEST - LED test (green LED)	
Glowing green	The status, display status and port status LED test is active. The “RM” LED status flashes green/yellow. The “FAULT” LED status flashes red. The display status LEDs flash green. The port status LEDs of the media modules flash green/yellow.
TP/FO - twisted pair / fiber optic (green LED)	
Glowing green	The port LEDs of the media modules display the media type.
All display status LEDs (green LEDs)	
Flashing in sequence	Initialization phase after restart
1 (green LED)	
	Service LED
PoE or 2 (green LED)	
Glowing green	The port LEDs of the media modules display the PoE status (Power over Ethernet).

ACA auto configuration adapter

RUN, 1 - display saving processes of the AutoConfiguration Adapter (ACA)	
Flashing alternately	Error during saving process.
LEDs flash synchronously, two times a second	Loading configuration from the ACA.
LEDs flash synchronously, once a second	Saving the configuration in the ACA.

Port state



These LEDs display port-related information. For each port, the following are available:

- Two one-color LEDs
- One two-color LED

You set the content of the information with the button on the basic device (see on page 42 „Port status“).

1 to n - data, link status (green/yellow LED)	
Not glowing	No valid connection.
Glowing green	Valid connection.
Flashing green (1 time a period)	Port is switched to stand-by (port 1).
Flashing green (3 times a period)	Port is switched off.
Flashing yellow	Data reception.
1 to n - FDX (green/yellow LED)	
Not glowing	Half-duplex is active.
Glowing green	Full-duplex is active.
1 to n – 1000 (green/yellow LED)	
Not glowing	10 Mbit/s is active.
Glowing green	100 Mbit/s is active.
Glowing yellow	1000 Mbit/s is active.
Flashing green/yellow	10000 Mbit/s is active.
1 to n – AUTONEG (green/yellow LED)	
Glowing green	Autonegotiation is active.
1 to n – TP/FO twisted pair / fiber optic (green/yellow LED)	
Glowing yellow	Fiber optic has been selected. The port LEDs of the media modules display the F/O ports.
Glowing green	Twisted pair has been selected. The port LEDs of the media modules display the twisted pair ports.
Not glowing	Autoselect, no medium has been selected
1 to n – RING PORT (green/yellow LED)	
Glowing green	This port is assigned to the HIPER-Ring.
1 to n – STAND-BY (green/yellow LED)	
Glowing green	Connection port for the data line.
Glowing yellow	Connection port for the control line.
Flashing green/yellow	No stand-by partner available.
1 to n – LED TEST (green/yellow LED)	
Not glowing	LED defective.
Flashing green/yellow	LED test is active.
1 to n – PoE (green/yellow LED)	
Glowing green	A PoE terminal device has registered and receives voltage via PoE.
Glowing yellow	Power over ETHERNET function activated, but no voltage is supplied via PoE.
Not glowing	No PoE port or: Power over ETHERNET function disabled (PoE port status = Disabled).

2.3 Basic set-up

The IP parameters must be entered when the device is installed for the first time. The device provides 6 options for configuring IP addresses:

- Entry via V.24 connection
- Entry using the HiDiscovery protocol
- Configuration via BOOTP
- Configuration via DHCP
- Configuration via DHCP Option 82
- Auto Configuration Adapter

Default settings

- IP address: The device looks for the IP address using DHCP
- Password for management:
  Login: user; password: public (read only)
  Login: admin; password: private (read and write)
- V.24 data rate: 9,600 Baud
- Ring redundancy: disabled
- Ethernet ports: link status is not evaluated (signal contact)
- Optical 100 Mbit/s ports: 100 Mbit/s, full duplex
  Optical 10 Gbit/s ports: 10 Gbit/s, full duplex
  All other ports: autonegotiation
- Ring manager disabled
- Stand-by coupling: disabled

USB interface

The USB socket has an interface for the local connection of an AutoConfiguration Adapter (part number ACA 21-USB see on page 47 „Accessories“). It is used for saving/loading the configuration and for loading the software.

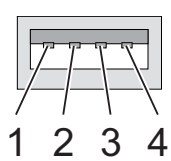
Figure	Pin	Function
 1 2 3 4	1	VCC (VBus)
	2	- Data
	3	+ Data
	4	Ground (GND)

Table 5: Pin assignment of the USB interface

V.24 interface (external management)

A serial interface is provided on the RJ11 socket (V.24 interface) for the local connection of an external management station (VT100 terminal or PC with corresponding terminal emulation). This enables you to set up a connection to the Command Line Interface (CLI) and to the system monitor.

VT 100 terminal settings	
Speed	9,600 Baud
Data	8 bit
Stopbit	1 bit
Handshake	off
Parity	none

The socket housing is electrically connected to the front panel of the device. The V.24 interface is not electrically isolated from the supply voltage.

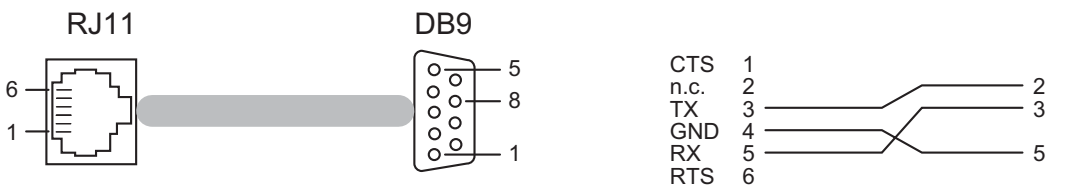


Figure 29: Pin assignment of the V.24 interface and wiring to the DB9 connector

Note: You will find the order number for the terminal cable, which is ordered separately, in the Technical Data chapter (see on page 48 „Technical data“).

You will find a detailed description of the configuration in the “Basic Configuration User Manual” on the CD-ROM.

2.4 Disassembly

Deinstalling the media modules

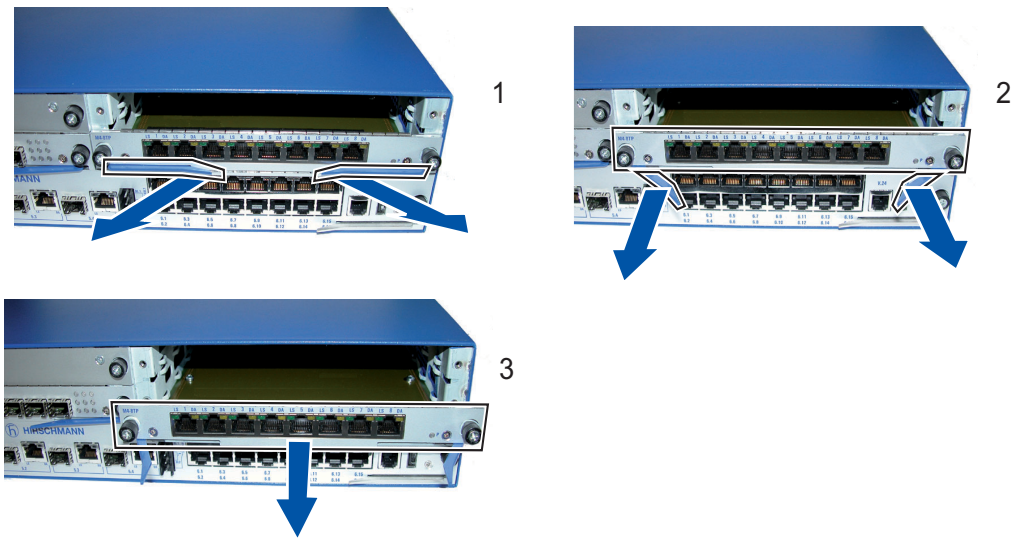


Figure 30: Deinstalling the media modules
1 - Step 1
2 - Step 2
3 - Step 3

- ☐ Note the ESD guidelines on page 10 and the safety instructions on page 5.
- ☐ Lever the selected media module from the slot by pulling the blue insertion catches (see Fig. above, steps 1 and 2).
- ☐ Pull the media module out of the slot (see Fig. above, step 3).
- ☐ Close the slot with a cover panel.
- ☐ Screw the four knurled screws in the cover panel flush with the frame of the basic device.

Deinstalling the SFP/XFP modules

- ☐ Pull the SFP/XFP module out of the socket by means of the opened lock.
- ☐ Close the SFP/XFP module with the protective cap.

3 Technical data

General technical data

Dimensions	MACH 4002-... M4-POWER	W x H x D: 480 mm x 88 mm x 435 mm W x H x D: 480 mm x 88 mm x 435 mm
Assembly	MACH 4002-... M4-POWER	19" switch cabinet 19" switch cabinet
Weight	MACH 4002-...	7.5 kg
Power supply	MACH 4002-...	M4-S-xx power unit or power unit chassis M4-POWER with M4-P-xx power unit, please order separately
Operating voltage	M4-S-AC/DC 300W M4-S-24VDC 300W M4-S-48VDC 300W	100-240 VAC +/- 10% 24 VDC (19.2 V - 32 V) [a] 48 VDC (38.4 V - 60 V) [a]
	M4-P-AC/DC 300W M4-P-24VDC 300W M4-P-48VDC 300W	100-240 VAC +/- 10% 24 VDC (19.2 V - 32 V) [a] 48 VDC (38.4 V - 60 V) [a]
Buffer time	M4-P-AC/DC 300W M4-...-24VDC 300W M4-...-48VDC 300W	min. 1/2 mains period min. 10 ms at 20.4 VDC min. 10 ms at 40.8 VDC
Current consumption	M4-S-AC/DC 300W M4-S-24VDC 300W M4-S-48VDC 300W	max. 1.7 A (240 VAC), max. 4.0 A (100 VAC) max. 16.0 A (24 VDC), max. 20 A (19.2 - 32 VDC) max. 8.0 A (48 VDC), max. 10 A (38.4 - 60 VDC)
	M4-P-AC/DC 300W M4-P-24VDC 300W M4-P-48VDC 300W	max. 1.7 A (240 VAC), max. 4.0 A (100 VAC) max. 16.0 A (24 VDC), max. 20 A (19.2 - 32 VDC) max. 8.0 A (48 VDC), max. 10 A (38.4 - 60 VDC)
Activation current	M4-S-AC/DC 300W M4-P-AC/DC 300W	typ. <40 A at 265 VAC and cold start typ. <40 A at 265 VAC and cold start
Overload current protection at input		Non-replaceable fuse
Potential difference between incoming voltage and housing	M4-...-...VDC 300W	Potential difference from incoming voltage +24 VDC/ +48VDC: 60 VDC Potential difference from incoming voltage 0V: 60 VDC [b]
Signal contact „FAULT“	Switching current Switching voltage Isolating voltage	max. 1 A, SELV max. 60 V DC or max. 30 V AC, SELV to front panel, voltage supply, other inputs/outputs: max. 1,500 V DC
Environment	Storage temperature Humidity Air pressure	Ambient air: -25 °C to +70 °C 10% to 95% (non-condensing) Up to 2000 m (795 hPa), higher altitudes on request
Operating temperature	MACH 4002-... M4-S-xx, M4-P-xx M-SFP-xx/xx M-XFP-xx/xx M-FAST SFP-xx/xx M4-8TP-RJ45 M4-8TP-RJ45 PoE M4-FAST 8-SFP M4-GIGA 8-SFP	With M4-AIR plug-in fan unit: Ambient air: 0 °C°C to +60 °C With M4-AIR-L plug-in fan unit: Ambient air: 0 °C to +40 °C

Pollution degree		2
Protection classes	Laser protection	Class 1 according to EN 60825-1 (2001)
	Protection class	IP 20

a. NEC Class 2 power source safety extra-low voltage (SELV/PELV)
b. The 0V connections within a DC module (M4-...-...VDC 300W) are connected with each other.

Interfaces

	Interface	Design
MACH 4002-...	Signal Contact	4-pin pluggable terminal block
	V.24 access	1 x RJ11 socket
	USB interface	For connecting an AutoConfiguration Adapter ACA 21-USB

EMC and immunity

EMC interference immunity		
IEC/EN 61000-4-2	Electrostatic discharge Contact discharge Air discharge	 6 kV 8 kV
IEC/EN 61000-4-3	Electromagnetic field 80 - 2,700 MHz	 10 V/m
IEC/EN 61000-4-4	Fast transients (burst) - Power line - Data line	 2 kV 4 kV
IEC/EN 61000-4-5	Voltage surges - Power line, line/line: - Power line, line/earth - Data line	 2 kV 2 kV 4 kV
IEC/EN 61000-4-6	Line-conducted interference voltages 150 kHz - 80 MHz	 10 V
EN 61000-4-9	Impulse-shaped magnetic fields	300 A/m
EMC emitted interference		
EN 55022	Class A	Yes
FCC 47 CFR Part 15	Class A	Yes
German Lloyd	Classification + Construction Guidelines VI-7-3 Part 1 Ed.2001	Yes
Stability		
Vibration	IEC 60068-2-6 Test FC test level according to IEC 61131-2	Yes
	Germanischer Lloyd Guidelines for the Performance of Type Tests Part 1	Yes
Shock	IEC 60068-2-27 Test Ea test level according to IEC 61131-2	Yes

Network range

TP port	
Length of a twisted pair segment	max. 100 m / 300 ft (cat5e cable with 1000BASE-T)

Table 6: TP port 10BASE-T / 100BASE-TX / 1000BASE-T

Product code M-FAST-SFP-...		Wave-length	Fiber	System attenuation	Example for fiber optic line length	Fiber data
-MM/LC...	MM	1310 nm	50/125 µm	0-11 dB	0-5 km	1.0 dB/km, 800 MHz*km
-MM/LC...	MM	1310 nm	62.5/125 µm	0-8 dB	0-4 km	1.0 dB/km, 500 MHz*km
-SM/LC...	SM	1310 nm	9/125 µm	0-13 dB	0-25 km	0.4 dB/km; 3.5 ps/(nm*km)
-SM+/ LC...	SM	1310 nm	9/125 µm	10-29 dB	25-65 km	0.4 dB/km; 3.5 ps/(nm*km)
-LH/LC	SM	1550 nm	9/125 µm	10-29 dB	40-104 km	0.25 dB/km; 19 ps/(nm*km)

Table 7: Fiber port 100BASE-FX (SFP fiber optic Fast ETHERNET Transceiver)

Product code M-SFP-...		Wave-length	Fiber	System attenuation	Example for fiber optic line length	Fiber data
-SX/LC...	MM	850 nm	50/125 µm	0-7.5 dB	0-550 m	3.0 dB/km, 400 MHz*km
-LX/LC...	MM	1310 nm[a]	50/125 µm	0-11 dB	0-550 m	1.0 dB/km, 800 MHz*km
-SX/LC...	MM	850 nm	62.5/125 µm	0-7.5 dB	0-275 m	3.2 dB/km, 200 MHz*km
-LX/LC...	MM	1310 nm [a]	62.5/125 µm	0-11 dB	0-550 m	1.0 dB/km, 500 MHz*km
-LX/LC...	SM	1310 nm	9/125 µm	0-11 dB	0-20 km	0.4 dB/km; 3.5 ps/(nm*km)
-LH/LC...	LH	1550 nm	9/125 µm	6-22 dB	24-72 km	0.25 dB/km; 19 ps/(nm*km)
-LH+/LC	LH	1550 nm	9/125 µm	15-32 dB	60-120 km	0.25 dB/km; 19 ps/(nm*km)

Table 8: Fiber port 1000BASE-FX (SFP fiber optic Gigabit ETHERNET Transceiver)

a. With F/O adapter compliant with IEEE 802.3-2002 clause 38 (single-mode fiber offset-launch mode conditioning patch cord)

Product code M-XFP-...		Wave-length	Fiber	System attenuation	Example for F/O line length	Fiber data
-SR/LC	MM	850 nm	62.5/125 µm	0-7.3 dB	2-26 m	1.6 dB/km, 160 MHz*km
-SR/LC	MM	850 nm	62.5/125 µm	0-7.3 dB	2-33 m	1.6 dB/km, 200 MHz*km
-SR/LC	MM	850 nm	50/125 µm	0-7.3 dB	2-66 m	1.7 dB/km, 400 MHz*km
-SR/LC	MM	850 nm	50/125 µm	0-7.3 dB	2-100 m	1.8 dB/km, 500 MHz*km
-SR/LC	MM	850 nm	50/125 µm	0-7.3 dB	2-300 m	2.6 dB/km, 2,000 MHz*km
-LR/LC	SM	1300 nm	9/125 µm	0-9.4 dB	2m -10 km	0.25 dB/km; 3.5 ps/(nm*km)
-ER/LC	SM	1550 nm	9/125 µm	3-15 dB	10-40 km	0.25 dB/km; 19 ps/(nm*km)
-ZR/LC	SM	1550 nm	9/125 µm	11-24 dB	40-80 km	0.25 dB/km; 19 ps/(nm*km)

Table 9: F/O port 10GBASE-SR/LR (XFP FO 10-Gigabit ETHERNET transceiver)

Product code M-SFP-BIDI...	Wave length TX	Wave length RX	Fiber	System attenuation	Expansion	Fiber data
Type A LX/LC EEC SM	1310 nm	1550 nm	9/125 µm	0-11 dB	0-20 km	0.4 dB/km, 3.5 ps/(nm*km)
Type B LX/LC EEC SM	1550 nm	1310 nm	9/125 µm	0-11 dB	0-20 km	0.4 dB/km, 3.5 ps/(nm*km)
Type A LH/LC EEC LH	1490 nm	1590 nm	9/125 µm	5-24 dB	23-80 km	0.25 dB/km, 3.5 ps/(nm*km)
Type B LH/LC EEC LH	1590 nm	1490 nm	9/125 µm	5-24 dB	23-80 km	0.25 dB/km, 3.5 ps/(nm*km)

Table 10: F/O port (bidirectional SFP transceiver)

MM = Multimode, SM = Singlemode, LH = Singlemode Longhaul

Power consumption/power output

Name	Power consumption	Power output
MACH4002-48+4G	66.0 W	225.3 Btu (IT)/h
MACH4002-24G	66.0 W	225.3 Btu (IT)/h
MACH4002-24G+3X	74.0 W	252.6 Btu (IT)/h
MACH4002-48G	118.0 W	402.7 Btu (IT)/h
MACH4002-48G+3X	125.0 W	426.6 Btu (IT)/h
M4-POWER	0.0 W	0.0 Btu (IT)/h
M4-S-AC/DC 300W (230 V)	350.0 W	170.7 Btu (IT)/h
M4-S-AC/DC 300W (110 V)	370.0 W	238.9 Btu (IT)/h
M4-S-24VDC 300W	380.0 W	273.0 Btu (IT)/h
M4-S-48VDC 300W	380.0 W	273.0 Btu (IT)/h
M4-P-AC/DC 300W (230 V)	350.0 W	170.7 Btu (IT)/h
M4-P-AC/DC 300W (110 V)	370.0 W	238.9 Btu (IT)/h
M4-P-24VDC 300W	380.0 W	273.0 Btu (IT)/h
M4-P-48VDC 300W	380.0 W	273.0 Btu (IT)/h
M-SFP-LH+/LC	1.0 W	3.4 Btu (IT)/h
M-SFP-LH/LC	1.0 W	3.4 Btu (IT)/h
M-SFP-LX/LC	1.0 W	3.4 Btu (IT)/h
M-SFP-SX/LC	1.0 W	3.4 Btu (IT)/h
M-FAST SFP-MM/LC	1.0 W	3.4 Btu (IT)/h
M-FAST SFP-SM/LC	1.0 W	3.4 Btu (IT)/h
M-FAST SFP-SM+/LC	1.0 W	3.4 Btu (IT)/h
M-FAST SFP-LH/LC	1.0 W	3.4 Btu (IT)/h
M-XFP-SR/LC	3.0 W	10.2 Btu (IT)/h
M-XFP-LR/LC	3.0 W	10.2 Btu (IT)/h
M-XFP-ER/LC	3.0 W	10.2 Btu (IT)/h
M-XFP-ZR/LC	3.0 W	10.2 Btu (IT)/h
M-SFP-BIDI Type A LX/LC EEC	1.0 W	3.4 Btu (IT)/h
M-SFP-BIDI Type B LX/LC EEC	1.0 W	3.4 Btu (IT)/h
M-SFP-BIDI Type A LH/LC EEC	1.0 W	3.4 Btu (IT)/h
M-SFP-BIDI Type B LH/LC EEC	1.0 W	3.4 Btu (IT)/h

Name	Power consumption	Power output
M4-8TP-RJ45	2.0 W	7.0 Btu (IT)/h
M4-8TP-RJ45 PoE	15.0 W	52.0 Btu (IT)/h
M4-FAST-SFP	15.0 W	52.0 Btu (IT)/h
M4-GIGA-SFP	3.0 W	10.2 Btu (IT)/h

Scope of delivery

Device	Scope of delivery
MACH 4002-...	MACH 4002-... Device 1 terminal block for relay contact (4 contacts) Terminal cable 19" bracket, mounted, 2 height units Installation user manual CD-ROM
M4-POWER	M4-POWER power unit chassis Installation user manual 19" bracket, mounted, 2 height units
M4-S-... 300W	Plug-in power unit for M4-S-... 300 W basic switch device Installation user manual Cable for AC connection for AC supply Connector for each DC connection for DC supply
M4-P-... 300W	Plug-in power unit for M4-P-... 300W power unit chassis Installation user manual Cable for AC connection for AC supply Connector for each DC connection for DC supply Power supply cable for connecting power unit chassis to basic switch device

Order numbers/product description

Product description	Description	Order No.
Basic devices		
	Basic switch device 48+4G (up to 48 Fast ETHERNET and 4 Gigabit ETHERNET ports) incl. plug-in fan without power supply	
MACH4002-48+4G-L2P	- with Layer2 Professional software	943 859-101
MACH4002-48+4G-L3E	- with Layer3 Enhanced software	943 859-201
MACH4002-48+4G-L3P	- with Layer3 Professional software	943 859-301
	Basic switch device 24G (up to 24 Gigabit ETHERNET ports) incl. plug-in fan without power supply	
MACH4002-24G-L2P	- with Layer2 Professional software	943 916-101
MACH4002-24G-L3E	- with Layer3 Enhanced software	943 916-201
MACH4002-24G-L3P	- with Layer3 Professional software	943 916-301
	Basic switch device 48G (up to 48 Gigabit ETHERNET ports) incl. plug-in fan without power supply	
MACH4002-48G-L2P	- with Layer2 Professional software	943 911-101
MACH4002-48G-L3E	- with Layer3 Enhanced software	943 911-201
MACH4002-48G-L3P	- with Layer3 Professional software	943 911-301

Product description	Description	Order No.
	Basic switch device 24G+3X (up to 24 Gigabit ETHERNET ports and three 10-Gigabit ETHERNET ports) incl. plug-in fan without power supply	
MACH4002-24G+3X-L2P	- with Layer2 Professional software	943 915-101
MACH4002-24G+3X-L3E	- with Layer3 Enhanced software	943 915-201
MACH4002-24G+3X-L3P	- with Layer3 Professional software	943 915-301
	Basic switch device 48G+3X (up to 48 Gigabit ETHERNET ports and three 10-Gigabit ETHERNET ports) incl. plug-in fan without power supply	
MACH4002-48G+3X-L2P	- with Layer2 Professional software	943 878-101
MACH4002-48G+3X-L3E	- with Layer3 Enhanced software	943 878-201
MACH4002-48G+3X-L3P	- with Layer3 Professional software	943 878-301
M4-POWER	Power unit chassis (for 3 slide-in units)	943 874-001
Plug-in fan units		
M4-AIR	Plug-in fan for MACH 4000 switch chassis without temperature sensor	943 869-001
M4-AIR-L	Plug-in fan for MACH 4000 switch chassis with reduced fan speed for use in ambient temperatures up to a maximum of +40 °C	942 005-001
Plug-in power units		
M4-S-AC/DC 300W	Plug-in AC power unit (300 W) for basic switch device	943 870-001
M4-S-24VDC 300W	Plug-in power unit 24VDC, single current, for basic switch device (2 connections coupled via diodes, one DC/DC converter)	943 871-001
M4-S-48VDC 300W	Plug-in power unit 48VDC, single current, for basic switch device (2 connections coupled via diodes, one DC/DC converter)	943 872-001
M4-P-AC/DC 300W	Plug-in AC power unit (300 W) for power unit chassis	943 875-001
M4-P-24VDC 300W	Plug-in 24VDC power unit, single-current, for power unit chassis (2 connections coupled via diodes, one DC/DC converter)	943 876-001
M4-P-48VDC 300W	Plug-in 48VDC power unit, single-current, for power unit chassis (2 connections coupled via diodes, one DC/DC converter)	943 877-001
Media modules		
M4-8TP-RJ45	Plug-in module 8 TP RJ45 (10/100, 10/100/1000)	943 863-001
M4-FAST 8TP-RJ45-PoE	Plug-in module 8 TP RJ45 PoE (Power over ETHERNET in compliance with IEEE 802.3af, 10/100)	943 873-001
M4-FAST 8-SFP	Plug-in module 8 SFP (100 HDX/FDX)	943 864-001
M4-GIGA 8-SFP	Plug-in module 8 SFP (100 FDX or 1000 FDX, depending on SFP)	943 879-001

Accessories

Note: Please note that products recommended as accessories may have characteristics that do not fully correspond to those of the corresponding product. This may limit their possible usage in the overall system.

Name	Operating temperature (chassis)	Order number
AutoConfiguration Adapter ACA 21-USB		943 271-001
Terminal cable		943 301-001
M4-POWER CABLE (connection cable red. power supply)		943 922-001
M4-RACKMOUNT (bracket for mounting the MACH 4000 in the 19" cabinet)		943 951-101
M4-RACKMOUNT-50 (19" bracket for mounting the MACH 4000 in the 19" cabinet, 50 mm lower than with M4_RACKMOUNT)		943 951-001
4-pin terminal block (50 units)		943 845-004
HiVision Network Management software		943 471-100
Industrial HiVision Network Management software, operator edition		943 156-xxx
OPC Server software HiOPC		943 055-001
10Gigabit ETHERNET XFP Transceiver		
M-XFP-SR/LC	0 °C to +60 °C	943 917-001
M-XFP-LR/LC	0 °C to +60 °C	943 919-001
M-XFP-ER/LC	0 °C to +60 °C	943 920-001
M-XFP-ZR/LC	0 °C to +60 °C	943 921-001
Gigabit ETHERNET SFP Transceiver		
M-SFP-SX/LC	0 °C to +60 °C	943 014-001
M-SFP-SX / LC EEC	-40 °C to +85 °C	943 896-001
M-SFP-LX/LC	0 °C to +60 °C	943 015-001
M-SFP-LX / LC EEC	-40 °C to +85 °C	943 897-001
M-SFP-LH/LC	0 °C to +60 °C	943 042-001
M-SFP-LH / LC EEC	-40 °C to +85 °C	943 898-001
M-SFP-LH+/LC	0 °C to +60 °C	943 049-001
Fast ETHERNET SFP Transceiver		
M-FAST SFP-MM/LC	0 °C to +60 °C	943 865-001
M-FAST SFP-MM / LC EEC	-40 °C to +85 °C	943 945-001
M-FAST SFP-SM/LC	0 °C to +60 °C	943 866-001
M-FAST SFP-SM / LC EEC	-40 °C to +85 °C	943 946-001
M-FAST SFP-SM+/LC	0 °C to +60 °C	943 867-001
M-FAST SFP-SM+/ LC EEC	-40 °C to +85 °C	943 947-001
M-FAST SFP-LH/LC	0 °C to +60 °C	943 868-001
Bidirectional SFP Transceiver		
M-SFP-BIDI Type A LX/LC EEC	-40 °C to +85 °C	943 974-001
M-SFP-BIDI Type B LX/LC EEC	-40 °C to +85 °C	943 974-002
M-SFP-BIDI Type A LH/LC EEC	-40 °C to +85 °C	943 975-001
M-SFP-BIDI Type B LH/LC EEC	-40 °C to +85 °C	943 975-002
M-SFP-BIDI Bundle LX/LC EEC (Type A + B)	-40 °C to +85 °C	943 974-101
M-SFP-BIDI Bundle LH/LC EEC (Type A + B)	-40 °C to +85 °C	943 975-101

Underlying norms and standards

Norm	
EN 61000-6-2:2005	Generic norm – immunity in industrial environments
EN 55022:2006	IT equipment – radio interference characteristics
IEC/EN 60950-1:2006	Safety for the installation of IT equipment
EN 61131-2:2003	Programmable logic controllers
EN 50121-4:2006	Railway applications - EMC - emitted interference and interference immunity for signal and telecommunication systems
FCC 47 CFR Part 15:2006	Code of Federal Regulations
Germanischer Lloyd	Ship Applications - Classification and Construction Guidelines VI-7-3 Part 1 Ed.2003
cUL 508:1998	Safety for Industrial Control Equipment
cUL 60950-1	Safety for Information Technology Equipment

Table 11: List of norms and standards. Certified devices are marked with a certification indicator. From the imprint on the device label you will see the current certification status of your device.

Certifications

The following table shows the status of the certification of the devices.

Standard	
cUL 508 / CSA C22.2 No.142	certified
cUL 60950 / CSA C22.2	certified
Germanischer Lloyd	certified

Table 12: Certifications - for the current status, visit www.hirschmann.com

Further support

Technical questions and training courses

In the event of technical queries, please contact your local Hirschmann distributor or Hirschmann office.
You can find the addresses of our distributors on the Internet: www.hirschmann-ac.com.

Our support line is also at your disposal:

- Tel. +49 1805 14-1538
- Fax +49 7127 14-1551

Answers to Frequently Asked Questions can be found on the Hirschmann internet site (www.hirschmann-ac.com) at the end of the product sites in the FAQ category.
The current training courses to technology and products can be found under http://www.hicomcenter.com.

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